Model Engineer

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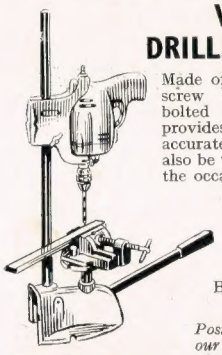

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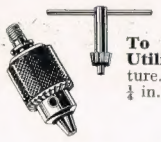

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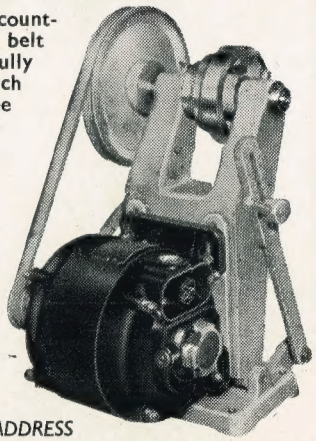

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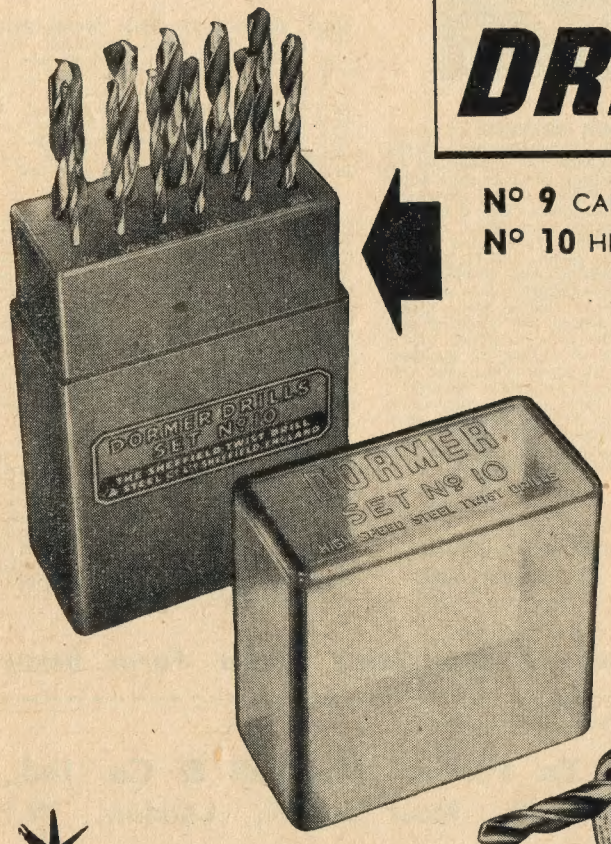

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Model Engineer

23 MAY 1957 VOLUME 116 No 2922

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Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

SEVENTY-FIVE years ago the observance of Queen Victoria's birthday, later to be kept as Empire Day (May 24), was marred in London by cloudy, squally weather. "Not a bit like May," said the people who hurried past the East India Docks, and few of them paused for long to admire a handsome clipper, the 1,320 ton *Dunedin* which had just berthed.

There were, however, others who welcomed the *Dunedin* with a feeling that history had been made. They knew that she carried the first cargo of New Zealand meat ever to be brought safely to Britain. She was a crack full-rigged iron ship belonging to the Albion Line (then owned by Patrick Henderson and Co. and later taken over by Shaw, Savil) and she had been built in 1874 by Duncan's of Port Glasgow who were famous for their clippers.

With a length of 241 ft, a beam of 36 ft and a hold depth of 20 ft, she had room for passengers as well as cargo.

Gold gingerbread-work set off the black and white of her hull and she looked every inch a fine ship as she sailed from the Clyde in August 1881 to pick up the meat far away in Port Chalmers—only a few miles from the town of Dunedin. She arrived safely and the cargo was loaded, but a series of mishaps dogged her return to Britain.

Passengers cried off

First, the crankshaft of the freezing-machine broke and the meat intended for Britain was eaten by the New Zealanders themselves before the loading was complete. The *Dunedin* sailed at last in February 1882, but all but two of her 60 passengers had such grave doubts that they cried off. Perhaps they were wise.

It was soon discovered that sparks from the funnel of the freezing engine had an alarming habit of setting fire to the great spread of canvas. This happened time and again, but the *Dunedin* survived to round the Horn.

For a long while she remained on one tack. The cold air stopped circulating, and Captain John Whitson, when he crawled in through a ventilating shaft to put things right, was frozen stiff and had to be hauled out by a rope fastened to his legs.

When she arrived in London after a voyage of 98 days all but one of the 5,000-odd carcasses, mostly mutton and lamb, were found to be in fine condition. The meat gained ready buyers and so began a great Commonwealth trade the anniversary of which New Zealand celebrates on Empire Day with an issue of special postage stamps.

The crack *Dunedin* should look well as a model. A further special interest would attach to the model inasmuch as the *Dunedin* was a ship which vanished. In 1890, with her sister ship *Marlborough*, she sailed from

SMOKE RINGS . . .

Oamuru on a sweepstake race. Before reaching the Horn she was spoken once; and no more is known of her. The *Marlborough*, which also vanished, was found by a naval survey ship in 1911 wrecked on the grim coast near Tierra del Fuego.

Skeletons lay on the deck, some with rusty pistols beside them, and experts agreed that the Crusoes must have lived for as long as six years on their cargo of meat and stores.

All knowledge of the *Dunedin* is lost in the vast silence of the ocean.

Maintaining small locos

SEEING the name of H. E. White at the head of the article on the simple return-bend for locomotive superheaters sent me thumbing through the book* which this author wrote about a year ago.

I found it full of valuable details on the subject of maintaining small locomotives and it got down to some of the elementary but necessary points which many writers assume, often erroneously, are known to the reader.

For example, he discusses such small items as the lighting of the fire and the equipment of the cab; and he devotes a dozen or more pages to the technique of driving and handling the miniature engine.

For those who intend running their locomotives in public there is guidance on the necessary safety precautions, types of couplings and track regulations and organisation.

Even those who do not operate or possess a model steam-engine would find this a refreshing book for its simplicity of style brings the reader into close proximity with the subject; one can almost smell that exciting odour of steam and oil oozing from the pages.

* "*Maintenance and Management of Small Locomotives*" *by H. E. White. Obtainable from Percival Marshall and Co.*, 19-20 *Noel Street, London, W.*1, *price* 12*s.* 6*d.*, *postage* 11*d.*

Tang of the sea

SINCE the integration of *Ships and Ship Models* with this journal the staff of MODEL ENGINEER have done their best to see that the needs of our maritime friends have been met.

Inevitably, some features have had to be jettisoned or stowed in the lower holds and one aspect that has suffered is the breath of the sea that gave *Ships and Ship Models* its salty tang.

The article by Bingham, therefore, should be pleasantly nostalgic to our shipping colleagues for it describes the construction of a sea-worthy yacht suitable for use in estuaries and coastal waters.

Moreover, for those model engineers who would like to turn their hands to something in full-scale, skill in operating the lathe can be very useful in the building of this vessel for home-made fittings would undoubtedly prove very much cheaper, and very likely better, than commercially-produced articles.

Model gas engines

THE handsome non-working scale model of a gas engine by H. F. Spurr, described in this issue, demonstrates that such engines offer excellent scope for modelling, but doubts have often been expressed as to whether they can be made as successful functional working models.

Such fears, however, are groundless; at one time stationary gas and oil engines were very popular as working models; castings and parts for their construction were supplied by several firms, and many finished examples made their appearance at M.E. Exhibitions in pre-war days.

It is a pity that interest in these engines has declined almost to vanishing point in recent years; no doubt this is partly due to the fact that few of our present generation of readers have seen the full-size engines, though they were once a serious rival to the steam-engine as a supply of power to industry. Another reason is that modern developments in i.c. engines have focused attention mainly on high speed and power output, which are not always the most attractive features from the aspect of the model engineer, and in some cases have engendered an active dislike of such engines.

The old type horizontal gas or oil engine, despite its relatively low efficiency according to modern standards, had many homely virtues; it was docile, reliable and quiet, besides being interesting both in construction and subsequent applications. Some of our readers who have had experience in the use of these engines for driving workshop and other machinery have preferred them to other sources of power, and even in small sizes, down to as low as 1 in. cylinder bore, they can be built to work not only as successfully but also as usefully, as in larger sizes.

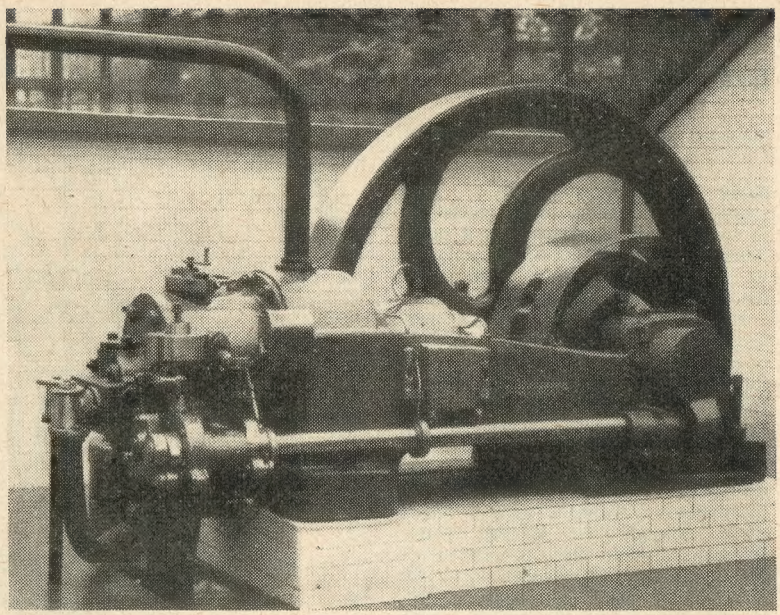
Cover picture

The Seal 15 *c.c. four-stroke four-cylinder engine. This robust little internal combustion engine, which can be put to utilitarian as well as modelling purposes, is a firm favourite. Working drawings are available from our Plans Service; please turn to pages* 748 *and* 749 *for details.*

The clipper DUNEDIN, *the first refrigerated ship on the New Zealand run. From a painting by Frank H. Mason, R.I., R.B.A.*
(By courtesy of the Shaw Savill and Albion Co.)

A MODEL GAS ENGINE

By
H. F. Spurr



Not every modeller's experience! This author had the fortune to secure a complete set of drawings for this engine, of 1907 vintage

WHEN I decided some 18 months ago to build a model of a gas engine I chose the National as being one I had had experience with more than 40 years ago.

I approached the National Gas and Oil Engine Co. Ltd to see if they would furnish me with a few of the principal dimensions. I was delighted—though somewhat taken aback—when they forwarded me a complete set of drawings for this particular model!

I have spent many happy hours studying these drawings, and the following notes and sketches describe how I built this model, which I have endeavoured to make as authentic as possible. The measurements given are those to which I worked.

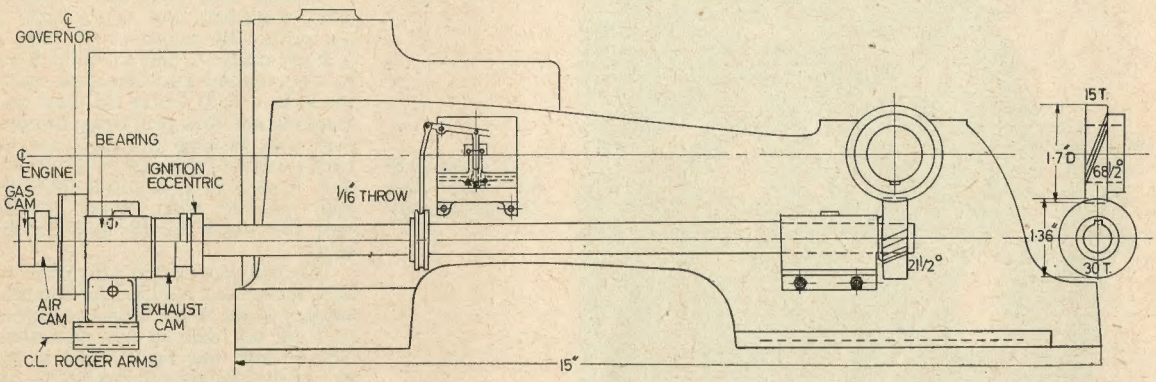
The first thing to produce was a pattern of the bed. This is a simple but sturdy casting in cast iron. An initial problem I came up against was how to produce the bosses for the bearings on each side of the body so that the pattern would leave the moulding sand. Eventually, after much cogitation, I hit upon the idea of making these loose with a small locating pin in the base and looped together with twine at the top to hang on the main body, much like two horseshoes.

This would allow the main pattern to be drawn out of the sand—upside-down, of course—and then the boss patterns could be picked out of the mould. I also made core patterns to be inserted to obtain the oil wells for the ring lubrication. Due allowance was made for the boring out to take the liner water seal, and also for the facing for the breach-end.

I made the pattern for the flywheel in two halves, with three locating pins, to allow for easier moulding, and was rewarded with a beautifully-clean casting. The valve chest was just a simple pattern, as was the outboard bearing—again with the loose bosses and a core for the oil well.

When I came to the breach-end I really did begin to think. There was so much detail involved that I could not see how to make a pattern, or the cores that would be required.

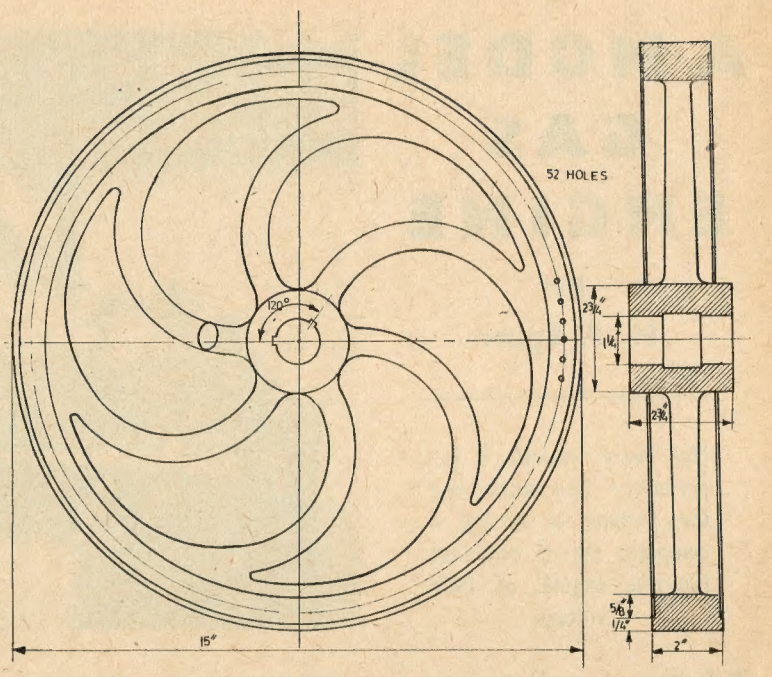
Eventually, I decided to fabricate this part. I bent a piece of sheet steel (about 14 gauge) into the form of an inverted U and then made a saw-cut up each side so that I could bend part of it into a circle. Around this circle I welded a ring of steel to



Above: Side view showing camshaft arrangement

Top: General view of the model

MODEL GAS ENGINE . . .



make the bolting-on flange. Two pieces of thicker steel were then welded in, one on the bottom with a piece going up to meet the circle, and one in the back-end to take the liner fixing bolts, and also the valve chest.

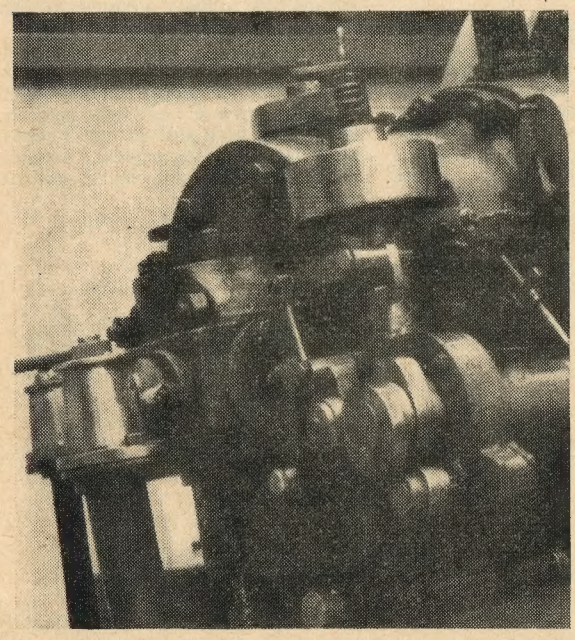
Next I obtained a piece of steel tube 1 in. o.d. $\frac{1}{8}$ in. thick. This I bored out to carry, at the bottom end, the loose valve seat for the exhaust valve, and then bored down from the top again to obtain a seating for the exhaust-valve cover. At the bottom end another piece of steel was pressed into position and bored out to carry the exhaust valve-stem guide, which came through the bottom plate. Between this stem guide and the valve-seat I cut a hole to enable me to fix an elbow to bring the exhaust gases to the outside of the water jacket (see section of breach-end).

The next move was to develop the explosion chamber; another piece of sheet steel was beaten into a hemisphere, a ring was welded to the outside edge to enable the liner seating to be turned and the dome end was filed and cut away until it fitted round the 1 in. tube. The area of tube so enclosed was then cut away to give access for the exhaust gases to the valve.

A further hole was then drilled through the tube, another one through the backplate and another smaller tube fitted to meet the valve chest. All these parts were then welded into position, and the seating for the liner and the flange to the bed were turned. After this I was able to bore out the bed to take the liner, cross-bore for the bearings, and face the breach-end.

When I came to the liner I was given little hope of getting a steel casting. It was only a small order, and, in any case, delivery was uncertain, so that was ruled out. However, after various inquiries I obtained a piece of steel tube which was thick enough for me to turn and bore, but not big enough to include the flange for the tie-bolts. This meant having a ring welded on to enable me to turn the flange. I then filed the ring to hexagon shape to allow for free circulation of the cooling water and fixed the tie-bolts in place.

The main bearings were made from a piece of hard brass tube 1 in. inside × 1⅛ in. o.d. This was slit into two halves and then sweated together again, which gave me just enough material to bore out 1 in. and finish to the dimensions given. Slots were then cut across the top brasses for the oiling rings.



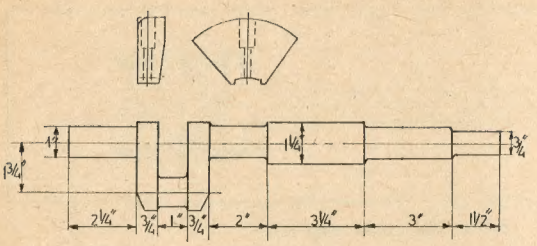
Top: The flywheel. Note position of the keyways. The shaft is held at three equal points

Left: Close-up of the valve gear and the governor

Built-up crankshaft

I would have preferred to turn a solid crankshaft, but as my lathe is not sufficiently robust to do this—it is home-made—I had to build it up to the required measurements, make the webs a tight fit on the shaft and crankpin and then drill down through each web, through the shaft and on until I was into the ends of the crankpin. A piece of $\frac{3}{16}$ in. silver steel was then pressed right down, leaving half the depth of the hole in the shaft.

This half was tapped $\frac{1}{4}$ in. Whit. to take the screws holding the counterweights to the webs. I did not braze as I did not wish to risk distortion. The oil hole was then drilled in the end of the crankpin to receive the oil pipe from the banjo which was



Details of the crankshaft, and side and end views of balance weight

screwed to the web by three copper rivets.

THE SIDESHAFT

I was now able to turn to the sideshaft, but before I could get the correct location it was necessary to make the gear wheels. At the same time I made the right-angle spiral gears for the governor. I ran into a bit of trouble with these, for I had to make four governor wheels before I had any success. Putting nine teeth at 39 1/3 deg. around a ¼ in. dia. wheel is a bit of a teaser.

It occurs to me here to give the number of teeth involved and the reason why an odd number of teeth is used. The driver from the crankshaft carries 15, meshing with 30 on the sideshaft, giving two to one. The number on the sideshaft governor wheel carries 31 meshing into 9 in the governor, giving 1 to 3 4/9. This obviously is to give sufficient speed to the governors to make them sensitive to any variation of speed; but there is another factor to be taken into account. Had the number of teeth been wholly divisible without any fractions left, an effect known as hunting creeps in. The effects of this can be cumulative and unless some combating means are introduced, it can be very troublesome. Hence the odd tooth.

I made the sideshaft out of a piece of ½ in. round shafting; both bearings are oil-ringed and the governor gearing runs in an oil bath. The bearing under the crankshaft presented no difficulty. The ½ in. bearing was mounted eccentrically inside a short piece of 1 in. tube, to allow the free movement of the oil ring. The ends of the 1 in. are sealed off to make the oil well and are then mounted on to an angle bracket which was bolted into position.

The cams

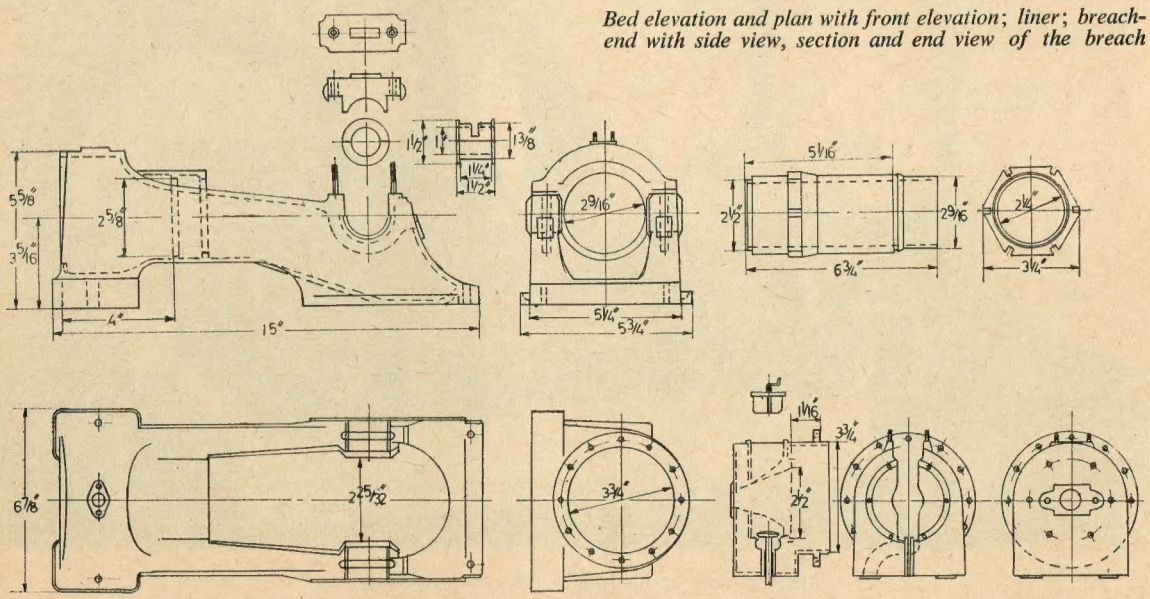
The bracket at the governor end was a little more difficult, as this has to carry (at the bottom) the shaft for the air and exhaust levers, and also the gear casing and trunnion of the governor. The cams presented no great difficulty, being drilled and bored out to fit the shaft, the boss turned and then thrown out of centre in a four-jaw chuck to produce the necessary throw of the cam, and afterwards filed to the correct contour.

The exhaust cam I had to reset twice in order to turn the small cam used for decompression when starting. The roller to this cam is made to slide on its pin on the exhaust lever. When starting, both cams operate until the engine is under way, then the roller is slid to the left and the peg which holds it in position is pressed into a hole in the roller pin. I was now able to line up correctly the sideshaft and turn my attention to the valve chest.

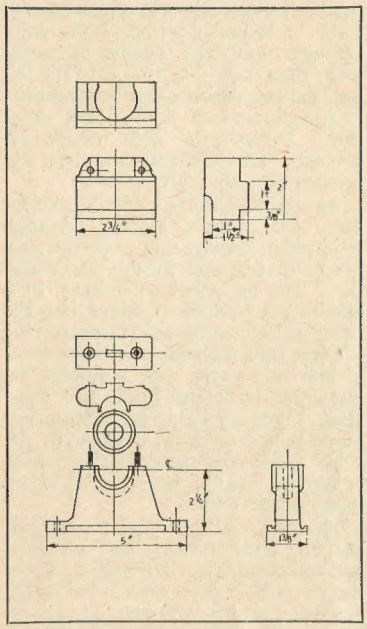
As can be seen from the drawings, there are quite a number of parts involved in making this, and some very careful boring and turning was called for. The gas valve is inverted in a small casing which is seated into the chest while a push rod is operated by the gas cam through to throttle lever at the other end. In addition, the air valve is seated inside the valve chest, but is carried in an independent guide bolted up from underneath the chest. The gas valve is also seated inside its casing, but carried in an independent guide.

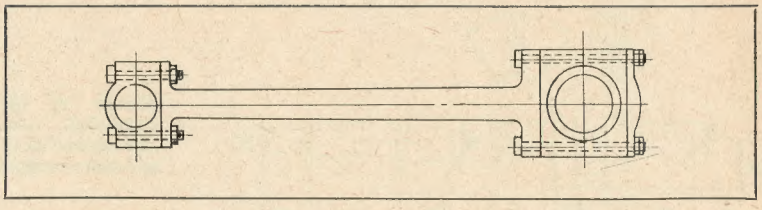
The gas and air cocks were bell shaped, taper turned, and the inlet and outlet were at right angles. From the air cock a ½ in. pipe is led to the air filter, which can just be seen in the picture behind the gas and air pipes, while a ⅜ in. pipe from the gas cock is led under the floor to the gas bag. The object of the gas bag was to have a damping effect on the pull of the engine, which would otherwise cause fluctuations in the

Bed elevation and plan with front elevation; liner; breach-end with side view, section and end view of the breach



MODEL GAS ENGINE . . .





Above: *The connecting rod*

Left: *The valve chest and outboard bearing*

gas mains. On the other side of the breach-end is the hand starting pump. (This cannot be seen in either picture.)

In the exhaust valve cover is a needle valve, hand-operated, and the pipe connection from the cover to the pump can be seen in the forward view.

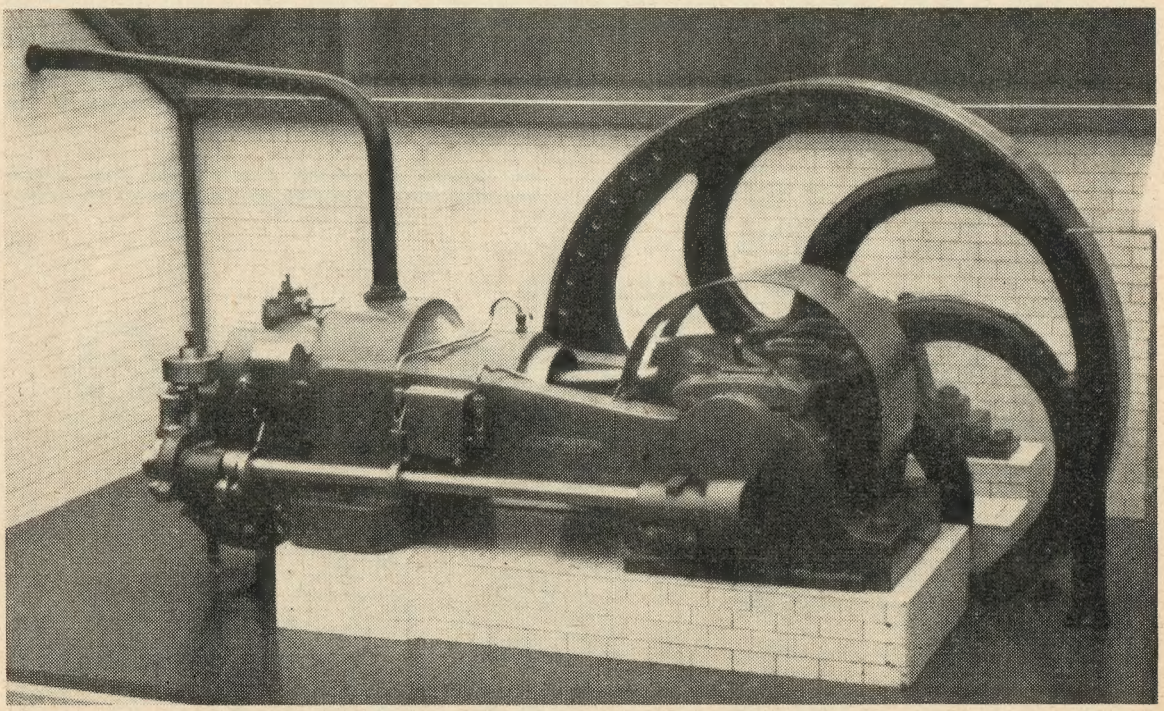
THE GOVERNOR

The governor column is mounted on the casing at the end of the bearing, and an arm projecting from the column carries the lever which, in turn, carries the rod holding the knife between the rocker arm and the palette. On the spindle, just above the column, is a bobbin. An offset fork in the lever runs in a groove at the bottom of the bobbin while at the top of the bobbin is a rim, under which the rollers of the weights operate.

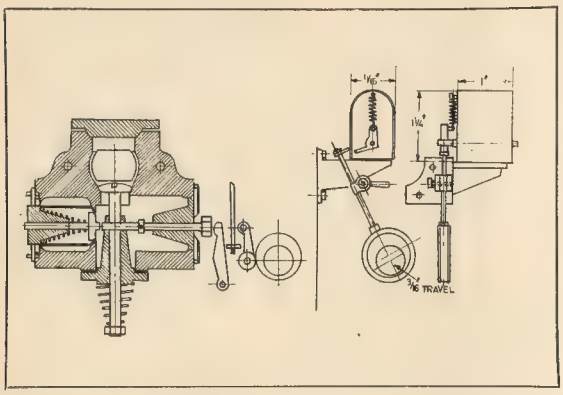
Above the bobbin a trunnion is fixed to the spindle with two arms either side set on a downward angle. The bell cranks carrying the inverted weights are set in between these arms, with the crank looking inwards and under the rim on the bobbin. Through the trunnion are three needles with free movement, to ride on top of the bobbin and under a loose sleeve on the spindle above the trunnion.

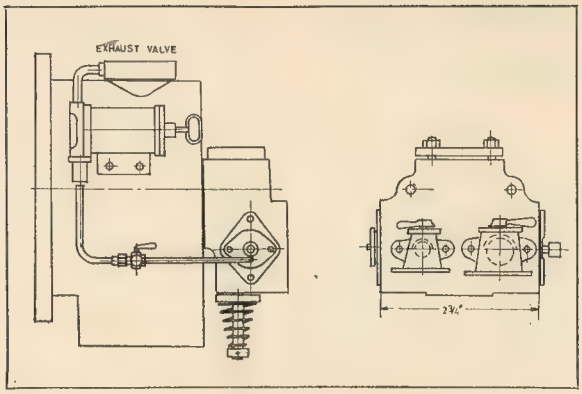
THE IGNITION

At the top of the spindle is an adjusting screw, and the pressure spring is carried on top of the loose sleeve and under the screw. At the side of the column and under the lever is a small rest, counterweighted, which holds the lever in starting position when the engine is at rest, and falls clear when running.



Another view of the engine from the crankshaft end





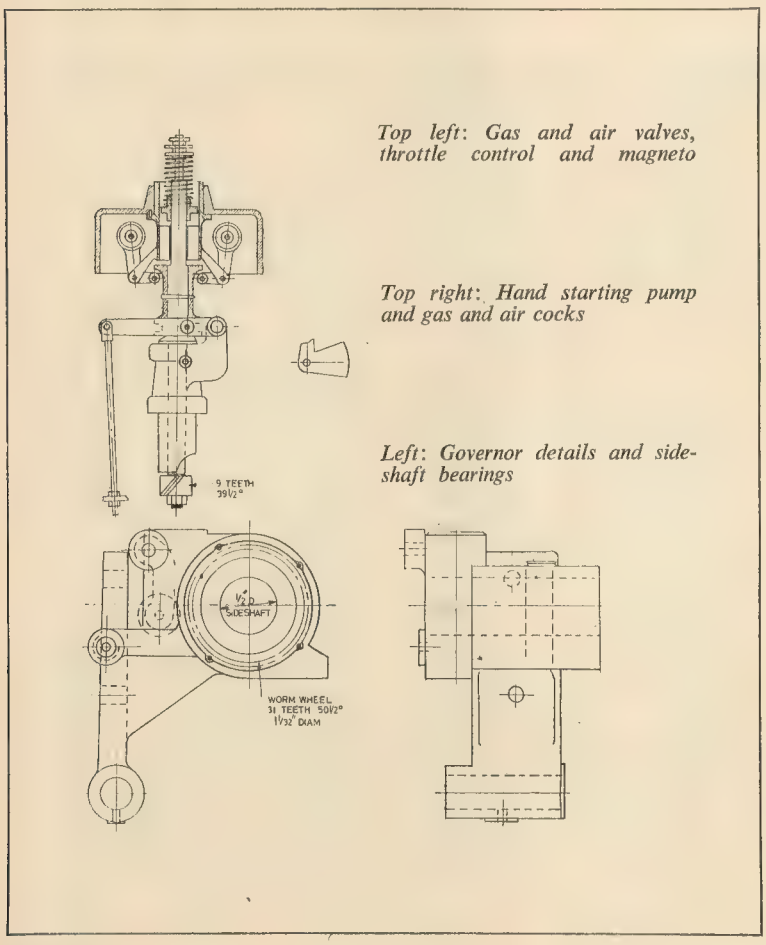
Ignition is by semi-rotary magneto. The plug is of the bolt pattern with an arm from the bolt resting on the lever on the magneto spindle. A rod rises from the eccentric sheave with a catch plate, which engages the trip lever on the magneto spindle. This rod runs through a guide which is mounted on an eccentric. By moving the lever on the eccentric the spark can be advanced or retarded.

The oil pump on the side on the engine feeds oil to the piston and little-end from the one side, and oil to the banjo for the big-end from the other. A rod, spring loaded, from the lever rides on the eccentric, which is so set that an impulse is given just as the piston is reaching the end of the forward stroke.

The connecting rod I cut out of a piece of mild steel 2 in. × $\frac{3}{4}$ in. and then turned it to the finished dimensions.

When I first thought of making this model my intention was to make it work, but as I progressed I realised it would be practically impossible to make a working magneto to the sizes given in my sketch. For the time being, therefore, I have fitted it with a dummy piston.

(If the electric ignition was connected to an outside supply it could, of course, be made a working model.)



Top left: *Gas and air valves, throttle control and magneto*

Top right: *Hand starting pump and gas and air cocks*

Left: *Governor details and side-shaft bearings*

HISTORY OF THE ENGINE

This particular type of engine developed 60 b.h.p. running at 230 r.p.m. and is throttle-controlled—that is, the gas was regulated on each power stroke according to the rise and fall of the governor arm as distinct from the earlier hit-and-miss type.

It is interesting to study the gradual development of the gas engine as a source of power during the latter half of the nineteenth century and early years of the present century when multi-cylinder engines of upwards of 1,500 h.p. were being produced.

After Murdock discovered how to produce gas from coal, many attempts were made to utilise its power in some form of engine; most of these proved to be very unsatisfactory, and it was not until 1860 that any progress was made. In that year a French engineer named Lenoir built an engine, double acting and using two slide-valves. This engine was manufactured in France and many were subsequently used in England. No very great success, however, was attained chiefly because of mechanical troubles.

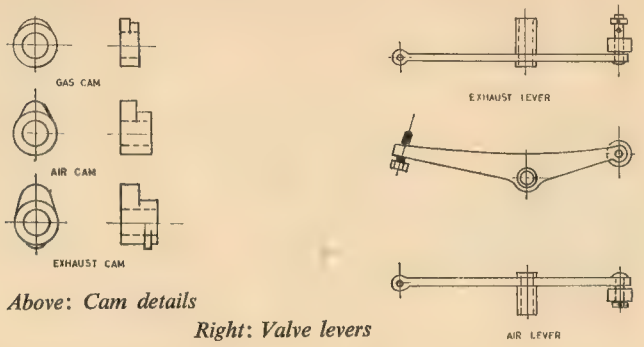
Two years later, in 1862, a French engineer, Beau-de-Rochas, suggested the now well-known four-cycle opera-

MODEL GAS ENGINE . . .

tion, but it was not until about 1870 that it was put to any practical use, when Dr Otto produced an engine using this principle.

Many different makes of engines were now being built, among them the Crossley, National Tangye, and Premier. To ensure the expulsion of the spent gases before a fresh charge was taken in, the Premier developed an engine with a truncated or double piston, one piston being larger than the other; the small one took the explosive charge while the other delivered a scavenging charge of air on the exhaust stroke.

Nearly all of the earlier engines were fired by hot-tube ignitors but later coil ignition and the semi-rotary magneto came into use.



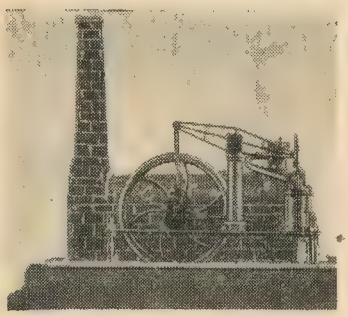
Above: Cam details

Right: Valve levers

In general, most of the different makes followed the same patterns—some with straight-spoked flywheels and some with curved spokes. But those with large single flywheels, with their shining faces, gave an impression of power much the same as did the majestic Corliss steam-engine.

There was a thrill in driving and controlling these engines—whether they were steam or gas—that cannot be experienced in the pushing of a button. And the old-time engineers gave them the same loving care as the old-time railway drivers gave their engines. Emery cloth and oil rag was used until every part glistened. ▣

MODEL STEAM-ENGINE IN SILVER



An historic miniature engine

By E.T.W.

ONE of the most famous scientific organisations in the world, The Franklin Institute, of Philadelphia, U.S.A., owns a museum in which, together with many notable relics of scientific and engineering progress, numerous models are exhibited.

One of the most interesting of these is the silver working model of a steam plant built about the middle of the last century by Cyrus Chambers, when he was only 16 years of age. Thanks to the courtesy of Mr T. Coulson, Director of Museum Research, we have been able to obtain a picture and description of this model, which has many features of outstanding interest.

1 in. chimney

The height of the boiler chimney is less than one inch, and the length of the baseplate, excluding the pyramidal foundation, only a little over an inch. It operates perfectly on steam, and was shown running at the Centennial Exposition of the Institute, but as the boiler is made of silver, compressed air is safer, and at present it is fitted with an electric motor drive so that it can be shown turning over at the request of visitors.

The engine, of the familiar centre-column type, has the characteristic "open work" beam which was extensively used in America, in contrast to the solid wrought- or cast-iron beam used in this country.

Over 150 separate pieces were used to construct the plant, which weighs slightly over half an ounce, and will run at over 3,000 r.p.m. under its own power, though this, of course, is far above normal working speed. Tradition says that the silver used in construction was obtained by melting down his mother's teaspoons !

While the claim of this model to being the smallest working steam-engine in the world might be open to dispute, its size is sufficiently diminutive to make one wonder how it could have been produced with the tools available at the time, and especially by one so young. It is not at all surprising to learn that Chambers, in later life, had a brilliant engineering career and had patented some 75 inventions before he died.

These varied widely, and included paper-folding machinery for book-printing, the basic principles of which are still in use up to the present day, and brick making plant capable of producing 25,000 bricks in an hour. In company with his elder brother Edwin, he founded the firm of Chambers Brothers which is still flourishing in Philadelphia.

And there is food for thought in the fact that it all started with a tiny—some might say insignificant—model steam-engine. ▣

Machining simple crankshafts

By GEOMETER

DEPENDING on its construction and the type of engine in which it will be fitted, the single-web crankshaft can be made in various ways. In a first-attempt small steam-engine everything may be arranged in the easiest manner, taking what might be regarded as a mechanical liberty, but excusable in the circumstances.

At the other extreme, in the case of a fast high-compression petrol engine, "correct" engineering principles in regard to the type of component must be followed—for to do otherwise would be courting disaster.

Making the crankshaft as simply as possible, flat plate material can be employed for the web, holes can be drilled and, if necessary, tapped for the mainshaft and crankpin. Then these two parts, to fit in the web, can be shouldered by turning in a lathe—from which it follows the essential alignment of the finished crankshaft will depend partly on the truth of the holes, but mostly on the shoulders abutting firmly to the parallel web material.

Using thick plate material for the web, basic alignment of mainshaft and crankpin holes is vital; so the holes should be drilled and bored with the material clamped to the lathe faceplate, or sub-faceplate—and this principle is extended to the more complicated constructions with separate webs.

But when for any reason, whether to further mechanical design or as an essay in turning skill, it is desired to machine a crankshaft from solid material, or true a brazed-up or welded-up type by light machining cuts, then the problem of mounting on the lathe finally reduces to achieving a suitable set-up for machining the crankpin in alignment with the mainshaft—since the mainshaft can be dealt with by centring the material each end and turning between centres. Thus, using round material for a machined-from-the-solid construction, there is after the first operation the finished mainshaft with a thick "web" at the end in which the crankpin is contained.

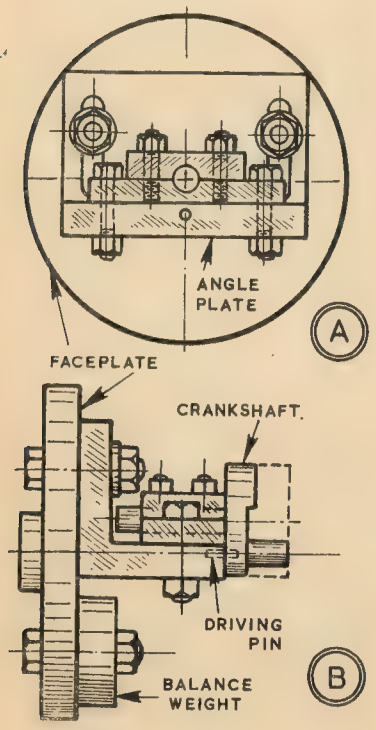
For the second operation, to machine the crankpin, either the mainshaft or the flat back of the web can be employed for setting up, the one requiring an angle-plate on the faceplate, as at *A* and *B*, the other a sub-faceplate, as at *C* and *D*.

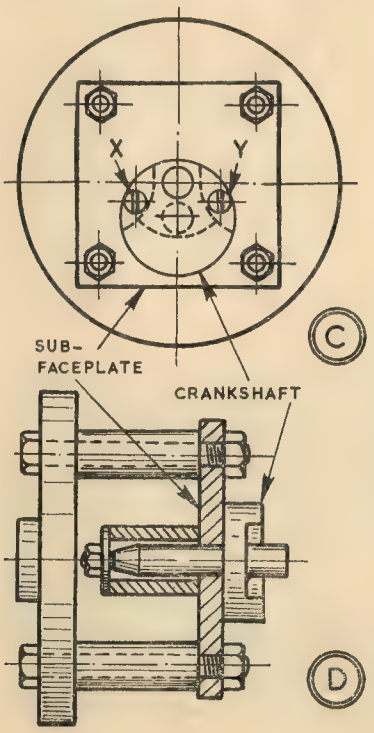
For the angle-plate set-up, two pieces of plate material can be used, comprising the base and the cap. The base should be bolted separately to the angle-plate and the cap attached by two or four studs to the base. To accept the mainshaft, the cap should be fitted with paper to the base (the paper finally being left out for the cap to grip) and the two drilled and bored on the joint line, as at *A*.

Where the crankpin will come, the angle-plate or base can be drilled for a small driving pin fitting in a hole in the back of the web. Then, with the crankpin centre marked on the front of the web, the shaft can be fitted and the angle-plate adjusted on the faceplate, as at *B*.

For the sub-faceplate set-up, any square or disc of plate material can be used—not less than about ¼ in. thick. Projection from the main faceplate can be achieved by equal-height metal blocks, or pieces of stiff tubing faced off to the same length for bolts; but for preference, blocks or parallel packing should be used. The sub-faceplate is bored to accept the mainshaft—and may also be faced for the web. As before, a driving pin can be fitted where the crankpin will come, the crankpin centre marked, and the shaft fitted. Then the sub-faceplate can be appropriately adjusted.

The shaft mounting can be in either of two ways. Parts of the web to be removed can be drilled for countersunk screws, as at *C*, *X*, *Y*, and nuts used to the sub-faceplate. When the shaft has a thread, however, this can be used, as at *D*. ▣





Invaluable for the workshop—a collection of articles on practical know-how: *Workshop Hints and Tips*, by Geometer, published by Percival Marshall, price 3s. 6d. (postage 3d.). U.S. and Canada $1.00.

A FLASH-STEAM CABIN CRUISER

Modellers who are enthusiastic about flash steam will find this constructional article by G. Eric Thomas of special interest

I AM a member of the West London Power Boat Club and have been running a very old hull which was carved from the solid many years ago. It has been powered by a flash-steam unit—and this unit I am going to use in the new hull.

My new hull was planned on the lines of the M.E. plan P.B.6. But I increased the dimensions proportionately to produce a hull approximately 4 ft 9 in. in length and 13 in. beam. From my pictures it will be seen that the plain keel of 1¼ in. × ¼ in. hardwood carries about 12 slotted-on fabricated formers of suitable sizes and angles in between the prow and the stern, the prow merely being a piece of flat hardwood screwed on top of the forward end of the keel and at an angle which ultimately determined the final angle of the bows.

When all the formers were screwed in place—the stern itself was made from a solid piece of board—the keel carried formers, stern board and prow piece. The keel was not made as a straight piece of wood; it is straight only for about two-thirds of its length, when it is spliced to run upwards on a slight angle sufficient to give a propeller clearance at the stern.

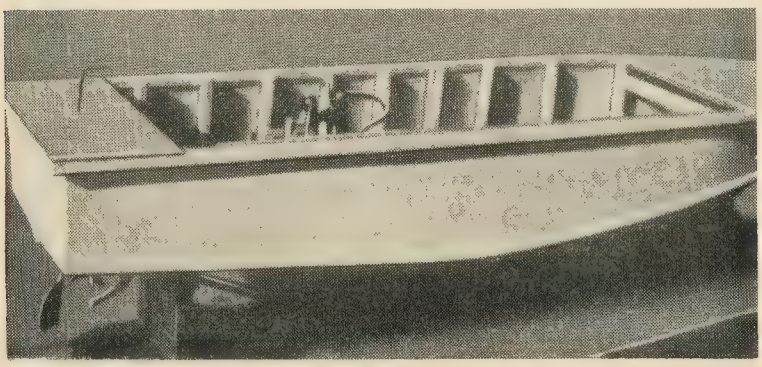
Water-soaking hint

Lengths of ¼ in square wood were then screwed on from stem to stern in four positions—two at either chine line and two at deck level either side of the framework. These pieces were let into the formers to fit flush with them, so having flat planes for the screwing-on of the two-ply sheets which I had bought for covering. The bending of the square bars of wood at the bows was attained by soaking them in water—aided by shallow saw cuts on the insides of the strips where the bends were most acute. (If you decide to make these cuts care must be taken not to weaken the wood too much or breakage will occur.) Success with these bends depends mainly on the amount of patience possessed by the bender.

My next job was the framework covering; this I carried out with two-ply sheets. My first sheet went on the bow under the chine line and my second above the chine line and on the same side. I then discovered, having screwed these panels down securely, that I had produced a distinct cork-screw effect . . .

It looked as though the proper course would have been to fit one panel to one side of the bows and the next in a similar position on the other side of the frame. However, I got a strong stiff piece of boarding and screwed it firmly all along the floor of the boat, thus forcibly correcting the twist and maintaining all formers horizontal at the base. This board I kept in position until the last screw was fitted on completion of the panelling. Four panels were fitted to the sides of the boat and four to the bottom. The baseboard was then removed—and, as there was no sign of distortion great relief was experienced.

A broadside view of the hull



The bare hull was then complete and ½ in. square strips of wood were screwed on outside and on each side at the chine line and at the deck line for the whole length of the boat. For the very important job of caulking and sealing the joints I used a mixture of red and white lead and gold size and then gave the hull one coat of underpaint outside and a coat of clear varnish inside.

THE FLASH-STEAM PLANT

I have been interested in flash steam for some time. My pumping unit is carried completely on a brass baseplate about 6 in. square, comprising one mechanical water pump, one hand water pump and one oil pump. The accompanying diagram gives the relative positions of the pumps and gearing.

The main drive comes from a small gearwheel on the main engine shaft and from this gear a large spur gear giving a 4½ to 1 reduction, drives a shaft carrying a crank-drive at one end of a shaft and a wormwheel between the large gear wheel and the crank disc. The crank disc has four positions for the crankpin, and these give four different lengths of stroke when connected with the ram of the water pump. The mechanical water pump is simple but effective with a ¼ in. ram and two simple ball valves for inlet and outlet.

The wormwheel, running at a ratio of 4½ to 1 with the engine, gives a final reduction of 20 to 1 (to engine speed) and rotates on a shaft at right angles to the longer shaft driven by the engine. The shaft driven by the worm gear, carries an eccentric sheave and arm which are connected to the oil pump—a small pump with a ram of only ⅛ in. dia. and a stroke of about ½ in. This pump also has simple ball valves like the water pumps.

When using flash steam it is essential to have an automatic oil pump. (Do not use an ordinary displacement lubricator.) The oil pump is connected direct to the main steam supply entrance to the engine through a check valve. The third pump on the baseplate is a hand pump for water, larger than the mechanical water pump but made on exactly the same principle.

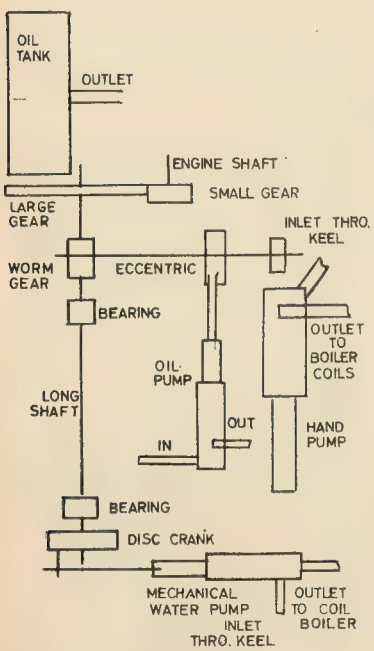
The boiler itself is made of 16 ft

of copper tubing, 10 ft of $\frac{1}{4}$ in. o.d. and 6 ft of $\frac{3}{16}$ in. in two coils of about 10 in. in length. One coil is inside the other, resulting in two ends —one of the $\frac{1}{4}$ in. tubing and one of the $\frac{3}{16}$ in.

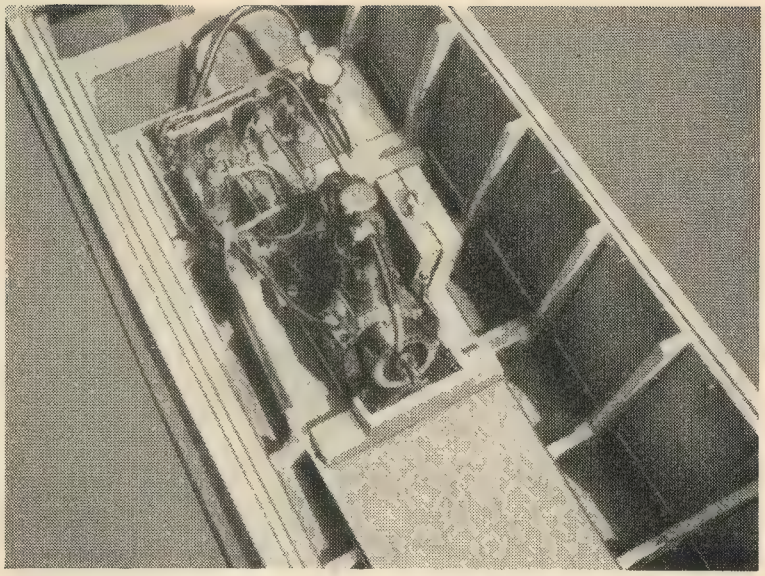
The two lengths of tubing were joined by a copper collar and silver soldered and the two coils were wound on a wooden mandrel, made for the purpose, which was about $1\frac{1}{2}$ in. dia. at one end and about 2 in. at the other. These coils were then housed in a strong casing with a circular opening at one end and a funnel opening at the top of the opposite end. From the funnel end protrude the two ends of the boiler tubing. One end leads direct to the engine—that is, the $\frac{1}{4}$ in. tubing. And the $\frac{3}{16}$ in. tubing end is fitted with a junction box carrying two check valves (one being connected to the mechanical water pump and the other to the hand pump). Both the water pumps are attached to pipes running through the keel to pick up water from the pond.

When the engine is running one pump is supplying water at a speed of $4\frac{1}{2}$ to 1 to engine speed and the oil pump is supplying oil to the engine at 20 to 1 engine speed. Both these speeds are faster than those I used with my old hull and it remains to be seen what adjustments will be necessary.

Instead of the eccentric arm being bolted to the oil-pump ram, I have filed the end of the arm into a hook made for this purpose. A handle fixed to the pump ram enables me to prime the engine with oil on starting—and this I do with the hooked eccentric arm disconnected from the pump ram. When sufficient oil has been pumped into the engine cylinder I hook up the eccentric to the ram by a spring. I can do this even with the engine running and the eccentric slowly rotating. I made this gadget because when starting up, mechanical pumping of oil is very slow.



Plan of the pumping unit



Layout of engine, pumps, oil tank and water intake

Speeds up to 12,000 r.p.m.

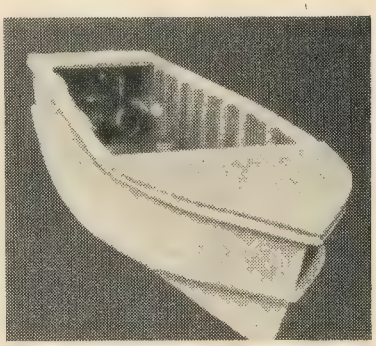
My present engine is a Uniflow type. This engine has given very good service and is capable of speeds up to 12,000 r.p.m.

I believe that much criticism is directed at flash steam on the grounds of lack of control or flexibility, but I have actually had my old boat anchored with the engine literally "ticking over" and the mechanical water pump doing only a few strokes per minute—the result of just a small flame from the blowlamp. (For blowlamp fuel I use high flash petroleum.)

If the flame should go out when using this fuel, easy ignition is provided —even with a cooling-off blowlamp nozzle. It is, I am afraid, expensive but I consider it well worth using.

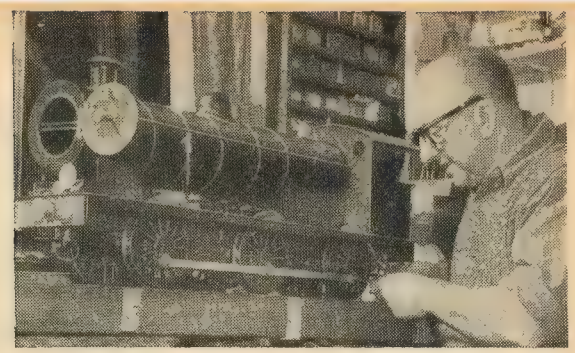
The starting up of my flash unit is very simple; the engine is primed with oil by hand operation of the pump, then water is gently pumped into the hot boiler coil and the propeller gently turned in its running direction. The steam-cock on the engine, open during this operation, results in condensate being expelled while the engine warms up. The engine itself soon starts up when the condensate is disposed of, but correct running conditions are gauged by the type of steam that emerges from the steam cock. This steam must not be at all wet—if it is it means that the ratio of water to heat is wrong, insufficient heat generally being indicated. This can quickly be remedied, and when there is no sign of moisture in the steam outlet at the steam-cock this may be shut when the engine picks up speed and the water-pump strokes increase proportionately.

The heart of a flash-steam unit is, to my mind, the mechanical water pump. If that is working correctly the boat can be run from a "putter" to full-steam ahead. I am now hoping that this new boat will attain a maximum speed of 15 knots or so at full-engine revs. ▣



Bows, showing chine line

NO SMOKE, MORE STEAM



ONE of the great advantages of smoking is that the smoker can save money in these times when saving becomes increasingly difficult. All that he need do is to stop.

Model engineers who have taken this step—which requires considerable heroism during the first few days—are able to spend more on tools and materials with consequences of such general benefit to their craft that they may soon cease to regret the lost pleasures of tobacco. I quote the example of Bill Nutting.

Mr Nutting works as a centre lathe turner in the machine shop of Goodwin, Barsby and Company, the well-known manufacturers of road, quarry, gravel and contractors' plant, at St Margaret's Ironworks, Leicester. He is a member of Leicester Society of Model Engineers whose track at Abbey Park is a joy to local children.

For three years now he has been building a new model locomotive, a C2X Southern Railway engine to 1 in. scale. This is his third work in live steam since he took to modelling at the end of the war, the other models being L.M.S. tanks, Class III and Class V, both fashioned to a scale of $\frac{1}{4}$ in.

So as to have more money for modelling he gave up smoking and used his new savings to buy a lathe and drilling machine and other tools. With these greatly enlarged facilities at his workshop in Penrith Road, Leicester, he is already contemplating, as his next choice, a showman's road locomotive "with all the trimmings."

Many modellers have a second interest or skill to engage their leisure: hence the variety which we discover in the programmes of club activities. Mr Nutting is no exception. As a photographer he won a prize in a national competition with a picture of a L.M.S.-type Class III locomotive drawing a goods train on the Lickey Incline.

Meanwhile summer is on its way and hosts of boys and girls are looking forward to rides in the sunshine. Mr Nutting, himself a bachelor, has a great fondness for children and enjoys the light in their eyes when they make friends with a model locomotive. It is a question who will be the happier, they or he, when the *Goodwin Special* goes on its maiden trip at Easter.

Here, then, is a modeller who has given up his smokes the better to raise more steam. How many others have decided to do the same—decided, and done it? J.M.

NEW TRACK RECORDING COACH FOR BRITISH RAILWAYS

SPECIAL railway vehicles equipped with recording gear designed to provide a record automatically of cant, curvature, gauge, etc., have been used in many parts of the world, including this country. But so far no vehicle has yet been produced with apparatus which can provide measurements as accurate as those obtainable by manual methods, and, at the same time, to do this at speeds which will not unduly interfere with normal traffic.

The constant search for quick and accurate methods of assessing the quality of track maintenance and assisting in its execution led British Railways civil engineers to draw up a specification for a two-axle self-propelled track recording coach.

After circulating a number of firms and discussing the problems with them, a development contract was placed with Elliott Bros of London (with Messrs David Wickham and Company of Ware as sub-contractors for the mechanical parts) for the manufacture of a prototype coach for service operational trial.

The problem of measuring cant is the establishment in the coach of a vertical which will remain undisturbed by the random motion of the vehicle travelling along the track, and by the centrifugal forces resulting in passage round a curve.

The specification calls for the measurement of cant to plus or minus $\frac{1}{8}$ in.; this is equivalent to plus or minus $7\frac{1}{2}$ min. of arc, and this angle is greater than the constancy of direction normally achievable by modern gyroscopic methods.

The gyroscope, which is gravity conscious and of a carefully selected natural period, is to be mounted on a platform attached in such a way to one of the axles of the vehicle that at all times it is parallel to the transverse axis of the axle, but independent of all other motions of the axle, the axle weight having been chosen to be adequate to eliminate voids under the sleepers in all conditions of operation.

The difference between the local vertical thus defined and the inclination of the platform and, hence, the axle, provides the measurement required. Those familiar with gyroscopic techniques will realise the technical problems involved.

The high accuracy required follows from the fact that a $\frac{1}{4}$ in. deviation from the required amount of cant can produce bad riding, particularly so if the periodic disturbance due to the track coincides at some speed with the natural frequency of the springing system of the vehicle. Even dangerous conditions have been known to arise from this cause.

The specification called for a measurement of offset to an accuracy of plus or minus 1/20 in. on a 33 ft chord. This is a fairly severe requirement, and the problem of achieving this depends not so much upon the accuracy of the instrumentation as on the accuracy of the probe system which will have to follow the lateral profile of the track including the effect of junctions and crossovers and curvature; the latter, of course, being the quantity required.

The probe system consists of three slippers bearing against the inner face of the rail, the distance between the centre slipper and the line connecting the two outer slippers, giving the offset and a measurement of curvature.

Preliminary experiments on a trail probe system over a distance of some 1,800 miles have indicated that the required probe accuracy can be achieved and that the wearing life is satisfactory. ▣

A simplified shooting stick . . .

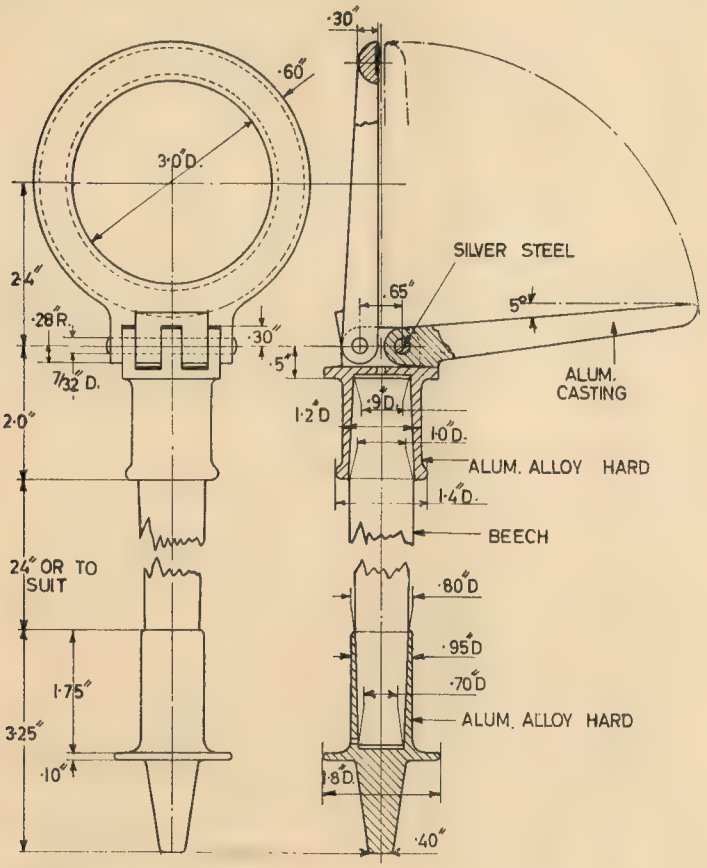
By H. J. TURPIN

As a young man I looked somewhat askance at a man carrying a shooting stick; but how useful one can be!

Since making, a few years ago, the stick described here it has always accompanied me to such places as club locomotive tracks and exhibitions where it is a relief sometimes to lighten the load on one's legs. It is really a worthwhile piece of model engineering and easy to make by the amateur.

There are very few parts, and all main dimensions appear on the drawing. The only thing to be determined is the total height and for this it is best to make a mock-up stick temporarily assembled to the fittings.

It is essential to make the head first as it contains the tapered hole, with 3/32 in. dia. vent into which the stock is fitted; also the hinge slots for the seat members. These slots must be milled parallel and prepared smooth to ensure a nice hinge action.



The seat is made in duplicate from aluminium castings. The ring-shaped handle enables the central hole and inner radius to be skimmed up in the lathe, while the outer radius, if not rotary milled, can be worked up by hand to template from the inner hole. That is how this one was made.

The material is easy to work and takes a good polish. For appearance's sake the face of each seat unit is recessed 1/32 in. deep × 0.4 in. wide and painted brown.

Constructing the hinge

A multi-lug hinge is not an easy thing to make as there are so many surfaces to make contact. The two seat members should be clamped face to face and the lugs milled in one setting to match those on the head. Failing that they could be shaped and fitted by hand.

When the hinge is fitted the next step is to drill and ream the 7/32 in. dia. axis pin holes square with the hinge slots; make a pair of filing buttons and round off the lugs to 0.28 in. radius.

The stick is made from beech and really requires the use of a woodworker's lathe to accommodate the length and to provide means of making nicely fitting tapers at each end. When the length has been determined and tapers are correct a thin film of gold size should be smeared on the wood to make a rigid joint when the tapers are driven home. Don't forget that the stick should not bottom in the holes.

It should be given a nice smooth finish, stained mahogany colour and shellac polished.

The foot is usually a detachable disc about 3 in. dia. carried on the side of the stick and it is available to screw on to the bottom ferrule for use on soft ground.

In order to simplify things this model has a reduced diameter disc integral with the ferrule, making it sufficient for soft ground and not at all cumbersome to be permanently fitted. ■

Readers' hints

This is the feature where readers exchange worthwhile ideas on workshop practice

REPLACING DRILLS

Most model engineers own a drill stand with a set of fractional drills $\frac{1}{16}$ in. to $\frac{1}{2}$ in. and also another drill stand with number drills 0 to 60.

At the end of an evening's work it is not unusual to have half a dozen drills lying about the bench and it is not always easy to replace the drills in their correct holes.

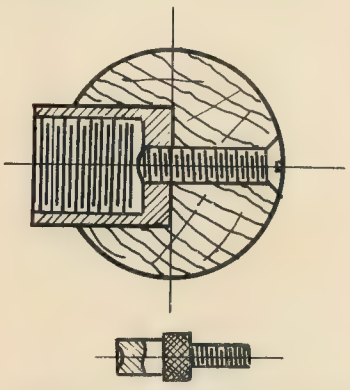
The numbers stamped on the shanks are often indecipherable, particularly after the drills have slipped in the chuck once or twice. There is then no quick way of distinguishing between the drills such as $\frac{1}{8}$ in., Nos 30, 31.

Recently, I have painted a coloured band with cellulose paint on each of my drills at the junction of the shank and flutes where the paint is least likely to be rubbed off.

All of the fractional drills are coloured red and the difference in size between holes in the drill stand is sufficient to ensure that the drills go back in the correct holes.

The difference in size between successive holes in the numbered drill stand is too slight to sort out successive drills such as 30, 31, 32. To overcome this snag the drills are coloured as follows: 0 black, 1 yellow, 2 blue, 3 orange, 4 green, 5 black, 6 yellow, 7 blue, 8 orange, 9 green and so on. The sets of colours are repeated at 0, 5, 10, 15, 20, etc.

A spot of the appropriate colour painted by each hole in the drill stand will ensure that each drill can readily be returned to its correct hole. —JOHN GRAY.



Additions to automatic punch. Wooden operating knob and concave rivet set

AUTOMATIC PUNCH

When I was an apprentice in a motor works over 50 years ago the construction of an automatic centre punch was a recognised "foreigner" for those who were nearly out of their time, and the finished article was generally criticised by the foreman with suitable but unprintable remarks concerning the workmanship.

I have three sizes of automatic punch (home made) in my workshop operating, of course, on the same underlying principles but having quite a different triggering mechanism.

The point of this letter, however, is to suggest an addition which I have found to be most comforting.

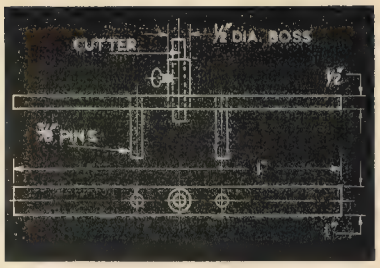
It is sometimes necessary to drill out shapes from steel plate which involve a large number of holes. Having made my hands sore in this process I thought of fitting a lignum vitae knob over the screw cap. The result was astonishingly satisfactory.

I find that a ball of $1\frac{1}{8}$ in. dia. is about right for a medium punch and $1\frac{3}{8}$ in. dia. for a heavy punch. The outside of the screw cap is rough finished, bedded in glue and held by a single central screw.

The heavy punch has a detachable point and I find that a concave headed "point" is useful for light riveting.—H. D. TEAGE.

KEYWAY CUTTER

This is a keyway cutter to use like a spokeshave on shafts. The bar is 1 ft long, $\frac{1}{2}$ in. thick and 1 in. wide with $\frac{1}{2}$ in. boss screwed in which houses the $\frac{1}{4}$ in. cutter, held in place by a small screw.



Details of the keyway cutter

Depth of cut is from the bar to the end of the cutter, which can be moved up or down. Two pins are screwed into the bar so that the shaft is located between them. The cutter is drawn towards the operator with the work held in a vice.

I find this is better than holding the work between centres and traversing the cross-slide.—F. LOVE.

Contributions to this feature are invited from readers. Each tip published wins a 10s. 6d. Percival Marshall book token

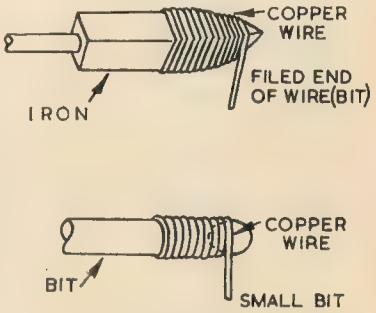
TINY SOLDER BIT

Those model engineers who make small ship fittings including stanchions, rails and other small work entailing fine soldering often find it difficult unless they possess a small pencil-bit soldering iron.

As these cost a lot, here is a method by which small work can be done by adapting the soldering iron generally in use, whether it be one heated externally or the larger type electric soldering iron.

All that is needed is a small length of copper wire, not so thin that it will bend too easily. First file one end of the wire to the shape of bit desired, then, as shown in the diagram, wind the wire around the soldering iron bit, the filed end protruding about $\frac{1}{2}$ in. at any convenient angle from the iron. Use as a normal iron.

The bit on the iron will heat the wire enabling the small bit to be used. —BASIL MACE.



A miniature soldering iron

BRISTLING IDEAS

I AM engaged in the construction of a small scale model of the windjammer *Penang*, to Mr Underhill's excellent drawings, and I have found many uses for the bristles from bass brooms.

They can be obtained in bundles from most hardware stores for a modest sum, so there is no necessity to remove portions of the wife's best yard broom ! The material is tough and pliable but has a tendency to split due to its fibrous nature. However, if very sharp blades and drills are used it can be worked quite satisfactorily.

Among the uses I have found for this material is the construction of that ship modeller's bogey—guard rails. I first draw out the extended elevation of the rail on card then, with the bristles forming the horizontal members lightly secured in position on the card, drill out holes for stanchions.

It is possible with care to drill holes only slightly less than the diameter of the bristle—owing to its high lateral strength—so a bristle only slightly larger than the stanchions can be selected. On removal from the card one prepared bristle is used as a jig to drill the deck.

Ordinary dressmaker's pins with their heads removed are then lightly tapped through the rails into the deck to correct scale height for stanchions (a small gauge cut from cardboard does admirably). The rails are then adjusted to correct height and a small dot of glue secures and forms the spherical junction.

After a coat of paint the difference in diameter between stanchions and rail is hardly noticeable. As the bristles vary in thickness and texture care should be taken in their selection.

Old plastic knitting needles are very handy for making winch drums and other similar tiny parts, but care should be taken to drill this material at very low speeds as it has a tendency to bind around the drill, when no amount of persuasion, gentle or otherwise, will release it.

The decorative scroll work at the figureheads and counters of ships of the clipper and carrier types I produce by drawing out the design on thin paper—the raised portion can be embossed from the reverse side with the point of a knitting needle, working on a bed of blotting paper.

The design is then cut out *en bloc* and glued in position making sure that plenty of glue fills up the raised portions. The paper, where not bordered by horizontal wales (broom bristles again split down the middle), can be "feathered out" to the surrounding surface with fine sand or garnett paper.—P. HALLIWELL.

RIGHT-ANGLE DRILL

FACED with the problem of drilling numerous holes on the lower decks of a model third-rate warship, I managed to overcome my difficulties by using a modified drilling attachment, normally used for a vastly different purpose.

I was able to obtain a second-hand dentist's right-angle handpiece, which I modified to suit my requirements as follows.

In order to attach it to a surplus flexible drive, a brass table lamp bush was sweated in to the end of the sleeve of the handpiece to fit the $\frac{1}{2}$ in. $\times$ 26 t.p.i. retaining nut on the drive and at the same time the spindle of the drive was extended with a short length of silver-steel rod, filed to engage the end of the spindle of the handpiece, as shown in the sketch. When driven by a small sewing machine motor, there is ample power for drilling in quite thick materials.

To adapt the business end of the handpiece for use with normal twist drills it was necessary for drills of 3/32 in. and over to turn down the end of the drills to 3/32 in. dia., file a small flat on them and make a shallow sawcut around the end of the drills to engage in the spring retaining clip.

For use with smaller drills, I obtained a small chuck from a jeweller's pin vice into which I hard soldered a short length of 3/32 in. silver-steel rod, also with a flat filed on it and the sawcut for retaining it in place as shown.

I have found this tool extremely useful for drilling holes in very awkward places as it can be manouevred through hatch openings or gunports, etc. Also, by using discarded dental burrs of various shapes, it is possible to carry out such operations as routing or slotting.—L. N. WATTS.

BOILER ENDPLATES

SOME time ago I made a Trident boiler as described in the old *Model Ships and Power Boats* in 1952 and 1953 and I found the trickiest piece of work was the casing endplate at the smokebox end. This arose from the fact that the boiler endplate is recessed into the boiler shell and the latter was cut off at an angle.

The various fittings attached to the boiler endplate were mounted on little "stand-pipes" which protrude through the casing endplate which had to be drilled so as to fit over about nine protrusions.

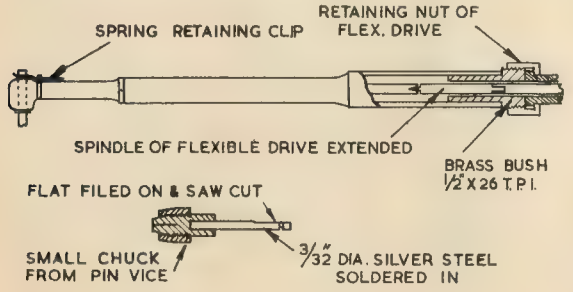
To do this neatly I first cut an endplate from scrap sheet aluminium and drilled it approximately for the various fittings. Where necessary these holes were roughly enlarged with a file so that the casing endplate would fit close up against the boiler shell.

A small piece of scrap of *irregular* shape was carefully drilled and filed oval for each size of standpipe, stay, and furnace tube. The appropriate piece was put over each protrusion in turn and its outline scribed on the rough casing endplate.

A piece of sheet steel for the final casing endplate was placed on the bench, the rough one placed on top of it and in turn each of the patterns for the holes was put in position according to the scribed shapes. The exact position and shape of each hole were thus scribed on the final endplate.

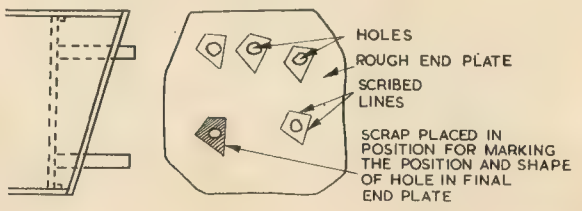
Each hole was drilled and filed to shape and when offered up to the boiler end was found to fit snugly over all the stand-pipes, etc. The outside shape was scribed from the lagged boiler shell and was finally cut to shape.

The result was a neat plate which will satisfy most judges.—C. R. HEWING.


RETAINING NUT OF FLEX. DRIVE
SPRING RETAINING CLIP
SPINDLE OF FLEXIBLE DRIVE EXTENDED
BRASS BUSH ½" X 26 T.P.I.
FLAT FILED ON & SAW CUT
SMALL CHUCK FROM PIN VICE
3/32" DIA. SILVER STEEL SOLDERED IN

Left: Details of flexible drive for drill

Below: Method of fixing boiler endplate


HOLES
ROUGH END PLATE
SCRIBED LINES
SCRAP PLACED IN POSITION FOR MARKING THE POSITION AND SHAPE OF HOLE IN FINAL END PLATE

H. E. WHITE gives details of a reliable spearhead which will avoid that embarrassing superheater failure

A simple return-bend for loco superheaters

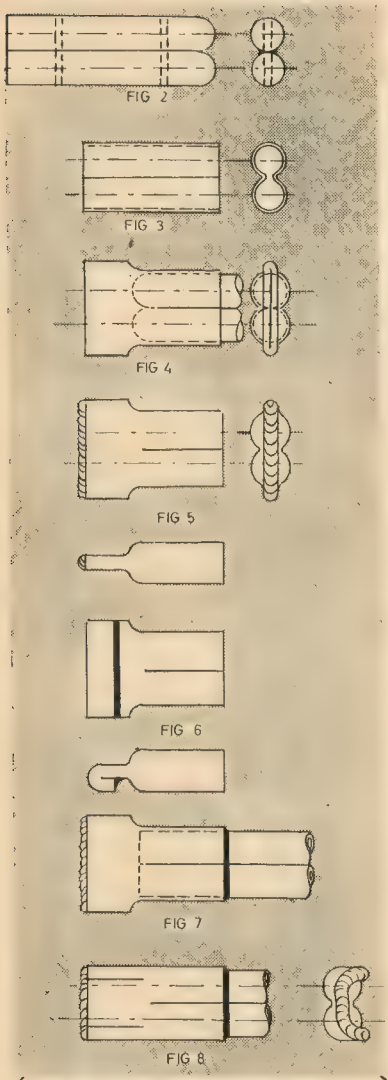


Fig. 2: Two lengths of steel rod riveted together and brazed at the joint make the former. Fig. 3: First stage in forming return-bend. Fig. 4: Second stage; squeezing end flat with former still in position. Fig. 5: Third stage; closing seam at flattened end with weld fillet. Fig. 6: Alternative method of closing end by folding and brazing. Fig. 7: Fourth stage; superheater tubes inserted and brazed in position. Fig. 8: Showing how flattened end may be bent to facilitate entry into superheater flue

NO UP-TO-DATE small locomotive of 3½ in. gauge and upwards uses "wet" steam: the value of drying, or better still, actually raising the temperature of the steam is now generally recognised; and the return-bend type of superheater, with its elements located in specially large diameter flues, is almost universally used.

In many cases three or four of these elements are made up into a single unit, the separate tubes being brazed into a common manifold, or "header." In the rough-and-tumble of hard-working locomotive running such as we experience at fetes and exhibitions, I have been rather surprised at the frequency with which superheater failures have occurred, and I fancy that the average small locomotive driver often does not appreciate the gruelling conditions under which these tubes have to do their job.

In a properly designed boiler, in which a suitable proportion of the hot products of combustion are drawn by the blast action through the superheater-flues, the spearhead elements are subjected to what amounts to a sand-blast of hot gases and fine cinders, particularly at their most vulnerable point—the return-bend.

The back-ends of the spearheads become worn so thin by this treatment that they eventually split open under the combined action of heat, abrasion and steam pressure, when this happens, immediately the regulator is opened we get a "blow" in the smokebox which puts out the fire instead of drawing it up!

Undoubtedly the best type of return-bend is the one which L.B.S.C. used to specify on all his engines, as shown in Fig. 1. This type is easy to make mechanically, and presents as little obstruction to the flue gases as possible, but there is one snag, and this, I imagine, was why our friend dropped it in favour of drilled solid-block return-bends.

The snag arises when the joint is brazed. It has a very long "seam" and in making sure that the brazing material has successfully penetrated the whole of the joint it is only too easy to fill the tube completely.

This difficulty may be largely overcome by using drilled blocks of copper as the return-bends; the holes can be drilled so that they are a tight fit for the superheater tubes, and it is a comparatively simple matter to keep the spelter where it should be when the joints are being brazed.

Again, of course, there is a snag. If the copper blocks are left fairly thick, so that they will stand the pressure and the abrasive effect of the cinderblast, they are apt to be bulky and obstruct the passage of hot gases through the flues. These gases will tend to pass through the smaller unobstructed flues, and this causes the superheater to be less effective than it otherwise would be.

Judicious filing will reduce the bulk of these blocks, but one has no way of telling whether or not it is safe to remove another few thou of copper.

After much thought (the most difficult part of the process, for me) the following dodge was tried. A separate return-bend unit was made up in one piece by using one short piece of copper tubing and "manipulating" it so that it had a cross-section like a figure eight.

One end was closed and the two superheater tubes were fitted into the other. The procedure is simple. Use a short piece (about 1¼ in.) of thin-walled tube, 20 gauge will do very well; it has a diameter *twice* that of the superheater tubes. This must be manipulated so that its cross-section resembles a figure eight, as in Fig. 3. This is easily done by using the former shown in Fig. 2.

The former is made from two short lengths of round steel with the ends rounded in the lathe with a fine file. Fasten them together temporarily with a couple of $\frac{1}{16}$ in. rivets and braze them together where they touch, using as little spelter as possible, so that the "waist" of the figure-of-eight will not be filled up. Squeeze the short length of tube into an elliptical section in the vice, coax it over the steel former until only about half-an-inch is left overhanging, and press the copper around the former until it conforms closely with the figure eight section.

It will be necessary to annea the piece of tubing once or twice in the usual way, by heating it to redness and quenching out in water. The forming of the waist can be done very easily with an ordinary pair of carpenter's pincers, after the sharp edges of the jaws have been stoned off so that they will not cut through the soft copper. The end must be squeezed flat in the vice while the steel former is still in position, and the joint closed with a nice fillet of welding bronze (Figs 4 and 5).

If you have no facilities for welding, simply fold over about $\frac{2}{16}$ in. of the at flend and close the joint by ordinary brazing methods, as shown in Fig. 6, using a hard spelter. Remove the former, insert the superheater tubes, and braze them into position (Fig. 7). There is very little likelihood of the joint filling, since the tubes will enter the return-bend to a depth of about $\frac{3}{4}$ in. A complete set of, say, four of these bends can be made up in a few minutes once you have made the former.

If the joint at the back end of the bend is made with a good hard brazing material, such as Sifbronze, and the tubes are brazed in with easy-running spelter, or a hard silver alloy (Johnson Matthey's B6), no difficulty should be experienced with the brazing.

You may find that the flattened end is a little too wide to pass through the superheater flue. If this is so, simply squeeze it in the vice until it *will* pass through, as in Fig. 8, or fold the projecting corners over, hammering them down neatly to finish the job, and render the cross-sectional area as small as possible. ▣

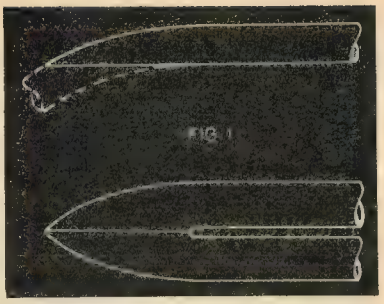


Fig. 1: Simple L.B.S.C.-type return-bend, showing tubes cut and joined by brazing

Automatic signalling at Camden Town Junction

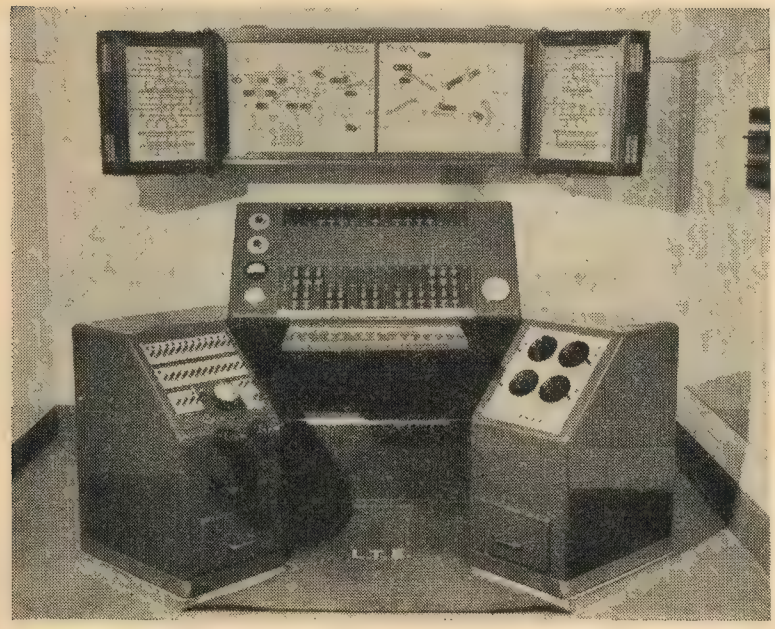
Trains at this busy four-way underground junction are signalled and switched completely automatically

CAMDEN TOWN is the most important junction on the London Transport tube lines for more than 1,200 trains pass through it daily. Hitherto it has been controlled by a manual power-operated signal cabin fitted with 46 levers. The installation, which was put in in 1924 outlived its useful life and was replaced by interlocking apparatus remotely controlled by the train description equipment.

The new installation, which allows completely automatic signalling and automatic movement of trains, is the first of its kind.

Trains pass through the junction to and from two branches to the north—Edgware and Barnet—and two branches to the south—the Charing Cross and City sides of the Northern Line. The signals worked from the station are located at Camden Town itself and at Belsize Park, Chalk Farm, Kentish Town, Mornington Crescent and Euston.

The control room on the site of the former signal cabin which can be used for manual routeing of trains



All routes which were signalled from the Camden Town cabin will now be signalled automatically, together with the appropriate point movements, by means of train descriptions set by the signalmen at Edgware, East Finchley and Kennington cabins.

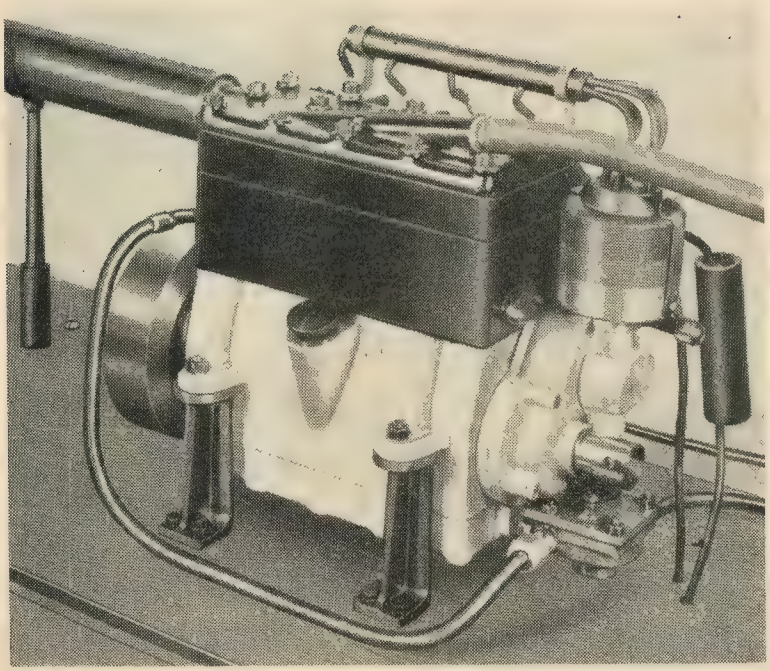
The new apparatus consists of three "interlocking machines" each in separate relay rooms. The first two, at Camden Town, actuate the signalling of the northbound and the southbound trains respectively. The third machine is at Mornington Crescent and operates signalling in the Mornington Crescent area.

The required route for each train is set on the train description apparatus as it leaves Edgware, East Finchley or Kennington, by the signalmen at these points. The information is stored at Camden Town and in due course relays cause the new interlocking machines to set up and signal the route through Camden Town.

Complete interlocking ensures that no unsafe or conflicting movements can be signalled. The installation is the first of its kind.

While the entire installation will operate automatically in the normal way, provision has also been made for push-button remote control operation of the interlocking machines from Camden Town when this may be necessary.

A control room has been provided on the site of the former cabin. ▣



Above: A completed Seal engine seen at an M.E. Exhibition

SEAL

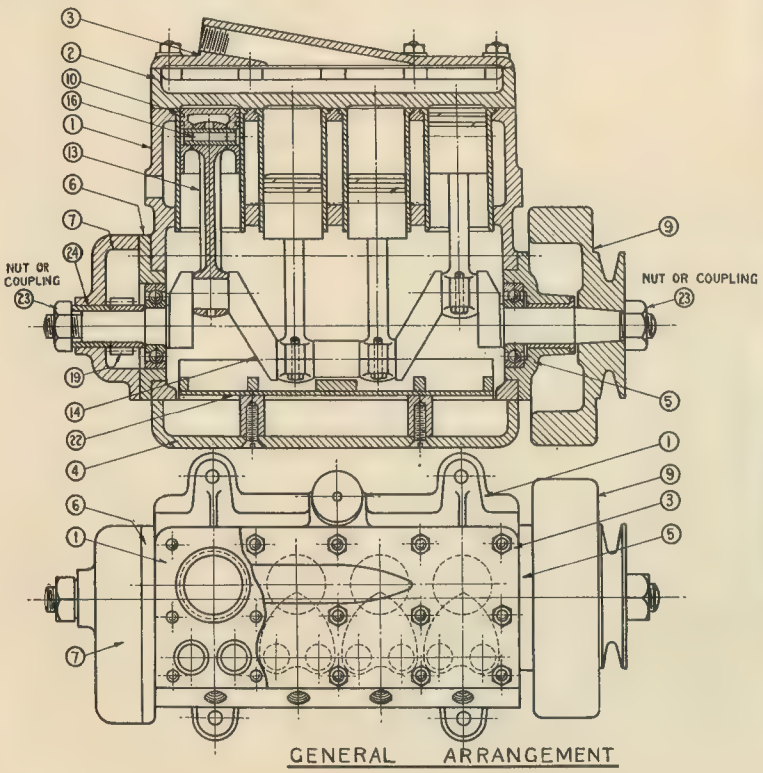
four-cylinder four-stroke engine

By E. T. Westbury

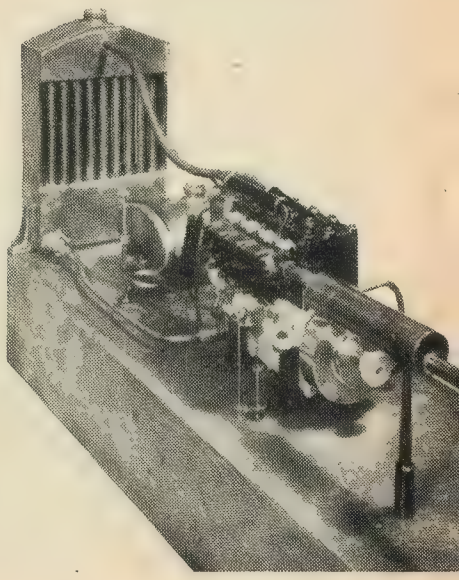
THIS IS ONE of the most popular of the M.E. petrol engine designs, being suited both in appearance and performance as a power unit for prototype model motor craft. It is not claimed to produce an extremely high efficiency for its size, but is quiet, reliable and controllable over a wide range of speed.

These properties are particularly valuable in radio-controlled craft, and it may be noted that the Seal is

Below: General arrangement drawing for a Seal engine



Another view of the Seal, showing tank and radiator pipe connections



the power unit for *Vanessa*, recently described by R. H. R. Curwen.

Multi-cylinder engines have a charm all their own, and give good scope for the constructional talents of the more advanced model engineers; but due to the straight-forward component design and planning of machining operations in the Seal engine, it has been built successfully by comparatively inexperienced constructors. No engines in this class are obtainable ready made.

The specification of the Seal engine is as follows:

Cylinders: water cooled, $\frac{5}{8}$ in. bore × $\frac{11}{16}$ in. stroke, with "wet" liners (capacity 15 c.c., but larger bore liners may be fitted to increase capacity to 18-20 c.c.); side valves, operated through flat-base adjustable tappets from spur-geared camshaft; standard compression ratio 5 to 1; lubrication by simple gravity system with troughs under big-end bearings; ignition by single-spark coil, with contact-breaker and high-tension distributor; barrel throttle compensated floatless carburettor.

Optional fittings include vertical distributor shaft, with water circulating pump driven from the lower end.

Drawings comprise two sheets, giving all above details, price 5s. ▣

An American builds the SEAL

R. T. EBERT tells of a successful attempt to build this robust little four-cylinder four-stroke

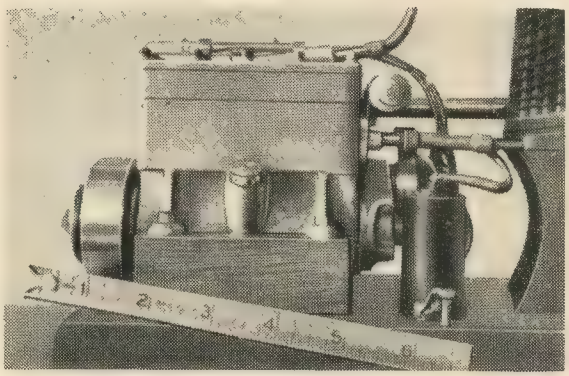
IT WAS JUST over a year ago that I received the castings for the Seal 15 c.c. four-stroke engine and I set to work to build it.

The crankshaft I made from cold-rolled steel and the camshaft was made in one piece from a jig, using 4140 cold-rolled steel. Pistons were made from aluminium bar, the rings being purchased from a supplier.

Cylinders and valve liners I machined from fine-grain cast iron, and I made them a cold fit in a warm block using a long-pilot located jig or mandrel.

A dummy brass liner was used for checking piston-rod-crankshaft alignment and for locating the notch in the liner which permits piston-rod clearance. Extreme care was taken with the liner top counterbore fits.

Valves are two-piece, with a 3/32 in. shaft and 9/32 in. wafer-head. They are silver steel (drill rod) silver soldered together. This method of construction avoids turning long fragile shafts.



The Seal built by Mr R. T. Ebert

The shafts were threaded for nuts and made $\frac{3}{8}$ in. overlength with the waste $\frac{3}{8}$ in. projecting from the top of the valve to provide chucking to turn the 45 deg. seat. After which the waste was cut off and the valve head faced.

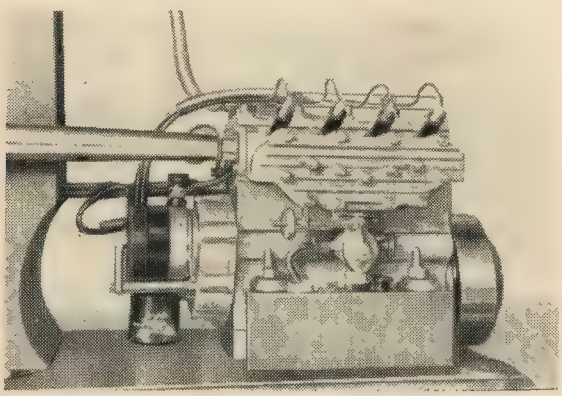
The oil drainpipe for flushing was screwed into the trough and extended through the base or mounting board, and a test tank of stainless steel was fitted to the side of the mounting block. The radiator was made from a sawn-out section of an old car part.

I used 90 octane non-leaded fuel and 30 wt. oil, and the engine ran and tuned up well on the first trial but showed slight leakage necessitating a head gasket. This I made from tough, long-fibre paper, smeared with a coating of thin, non-hardening Permatex, and it gave excellent results.

To improve water circulation I screwed and plugged the 5/32 in. holes and redrilled them No 41, equal to $\frac{3}{16}$ in. i.d.

The entire job took 375 hours over the course of seven months and cost £14 for materials. No serious troubles were encountered, although the work was not simple. Previous experience on three assorted side-valve and overhead engines proved very helpful.

The Seal is shown in the picture complete and ready for the 3 v. battery to be attached. The project made very entertaining work, but no difficult details were sacrificed. ▣



Another view of the Ebert-built engine

TRICKS OF THE TRADE

Now here are a few more ruses drawn from L.B.S.C.'s experience which should be useful to all engaged in the building and operation of small locomotives

An old correspondent who has built several 3½ in. gauge locomotives, one of which is a big tank engine, says that he had trouble with the lubrication of the axleboxes of the coupled wheels of this engine; they are under the side tanks and so very inaccessible.

He fitted first of all a regulation-type oil box at each side just ahead of the tanks, where they are usually fitted in full-size practice, with small pipes to the boxes. But owing to the big wheels and, consequently, high position of the boxes, the fall of the pipes was found to be insufficient. He, therefore, fitted fresh boxes at the top of the tanks, letting them in flush with the tank tops so that they would not be unsightly—he believes in having them plenty large enough! The pipes, which, of course, had a steep drop, were taken out near the bottom of the tank and so arranged that the ends were automatically located over the axleboxes when the tanks were erected in their proper position. This proved satisfactory.

This idea reminded me of a trick which I worked out many years ago, but have never described in these notes. The problem was pretty much the same, but the way I solved it was entirely different, and the method may be useful to prospective builders of engines like *Helen Long*.

Many automobile engines have drilled crankshafts, and the oil is fed by pressure through the ducts to the main bearings and big-ends. I thought that this idea might be easily applied to locomotive axleboxes, and the reproduced drawing shows how it can be done. The ends of the axle are drilled and countersunk, and a cross-hole is drilled across the middle of the part which runs in the axlebox. Two small holes are drilled right across the axlebox itself from one of the hornblock rubbing-faces to the other, cutting across the hole in which the axle runs. A very shallow groove, no more than a glorified scratch, is cut in both axle journal and box, at all the points where the holes emerge.

If oil is applied by a pressure feeder to the countersunk hole at the end of the axle—readily accessible as it is in the middle of the wheel—it goes down the duct and through the cross-hole, slap into the journal. Some of it will also go through the holes between the journal and hornblock rubbing-faces in the axlebox, thus oiling the whole bag of tricks at one fell swoop. In addition, it clears out any grit that may have managed to get into an axlebox that comes under the firebox.

After the show is over . . .

I have never had any trouble in this direction as I always take good care to wipe the axle and put some thick cylinder-oil in the bearings after finishing a run when I drop the residue from the firebox. But following a performance t a club track the engine is usually dumped straight into the owner's car—and when the owner gets home he is usually too tired or otherwise indisposed to give the engine a proper clean down before putting it away! Incidentally, I have described several times how an axle under the firebox may be shielded.

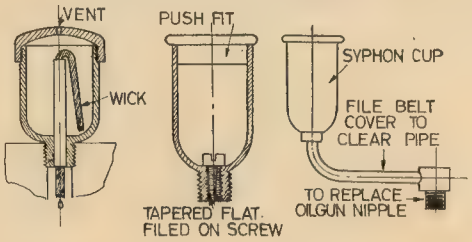
This method of lubrication merely adds a few minutes' work to the machining. When turning the wheel seats, centre the end of the axle, letting the centre-drill go in just deep enough to form a shallow countersink. Drill down with a $\frac{1}{16}$ in. drill to the depth of the wheel seat, plus three-quarters of the length of the bearing. The crosshole should be drilled $\frac{1}{16}$ in. and located so that it is right in the middle of the bearing, the distance from the wheel seat being equal to half the thickness of the axlebox. The holes in the axlebox should line up with those in the axle. The grooves can be made with a small pointed chisel or the ground-off end of a three-cornered file—but be sure to avoid leaving a sharp edge which would score the axlebox.

PRESSURE FEEDER

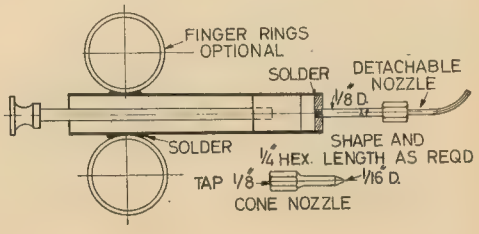
Most drivers of small locomotives nowadays use the commercial pump-operated oilers sold at all toolmakers' and ironmongers' stores. I have three Wesco and two Kaye oilers, all with pumps. They have conical-ended spouts which can be pushed tightly into oil holes, whether plain or countersunk, and the oil goes where needed instead of being wasted.

One of the Wesco type is used for cylinder oil only, and I enlarged the nozzle for quick filling of the mechanical lubricator tanks. Another has a 6 in. length of ⅛ in. copper tube soldered to the nozzle. With this merchant I can get at the "works" and axleboxes of any of my engines, either tank or tender. For illuminating the dark corners when oiling up, I use a "torchlamp" which consists of an ordinary flat pocket torch with an extension lampholder at one end made from a piece of brass tube with a screw cap from a defunct bulb, and a socket at the other, and an

A commercial syphon oil cup; oil cup with a regulating screw; arrangement fitted to a Myford tail bearing



A syringe-type pressure feeder



insulated wire connects the two. This can be poked in between tanks or splashers and I can see where to put the oil.

I might mention that the rails on my little line are always quite dry when only my own engines run on it. At one time I used to let other folk run their engines on it, with the result that the rails usually became smothered with oil. Thus I had to clean all the railheads with petrol and a felt pad before I could resume. My single-driver engines will pull a load on dry rails quite well without any sand, but they naturally won't bite on greasy rails.

Now pressure oilers

For the benefit of our do-it-yourself friends who like to make their own blobs and gadgets, here are a couple of sketches showing how pressure oilers can be easily made in a very short time. The first is a plain syringe, the barrel being a length of thin brass tube, the kind known in the trade as "treblet" being the most suitable.

The length and diameter can be anything to suit material available or maker's wishes; I have one here at the present moment, 4 in. long and $\frac{9}{16}$ in. dia., which is a handy size. One end is left open, the other being closed by a disc of brass $\frac{1}{8}$ in. thick, turned to a press fit and soldered. Drop a few spots of soldering fluid inside, with a blob of solder about the size of a domestic pin head, and hold it over a gas or spirit flame until the solder melts and runs around the edge of the disc in a fillet.

Wash out all traces of the soldering fluid, then chuck the tube in the three-jaw, taking care to avoid distorting it, centre, drill No 40 and tap the disc $\frac{1}{8}$ in. or 5 B.A. Fit about 2 in. of $\frac{1}{8}$ in. tube screwed at both ends. This allows for any size or shape of nozzle being attached by tapped sockets made from $\frac{1}{4}$ in. hexagon rod, the nozzles being made from tube soldered into the blind end of the socket.

The plunger or ram is a $\frac{3}{4}$ in. length of brass rod turned to a sliding fit in the tube, just like turning a piston. After turning, centre it, drill 5/32 in. for $\frac{1}{4}$ in. depth and tap $\frac{3}{16}$ in. × 40, then part off and fit a piece of $\frac{3}{16}$ in. brass rod in it, screwed both ends. The rod should be the same length as the pump barrel, and a turned knob should be screwed on to the end. If a conical nozzle is made in addition to the tube nozzles, this pump can be used to oil the axle-bearings from outside the wheels as described. By fitting a couple of rings or hooks to the sides, it can be operated with one hand, like a hypodermic syringe. To fill, pull out the piston.

The other oiler is a variation of the usual type of grease gun used for automobile greasing. The barrel is a tube, as before, but the hole in the disc is drilled $\frac{3}{16}$ in. clearing, and the outer end is furnished with a screwed cap. The piston rod is hollow, made from $\frac{3}{16}$ in. thick-walled brass tube, and the end is screwed and fitted with a conical nozzle drilled about $\frac{1}{16}$ in. Turn a groove in the piston and pack it with graphited yarn as for a steam piston.

To fill this one, pull out the piston rod as far as it will go, then take the cap off the other end and fill the barrel. The cap should have a washer inside made from oilproof rubber or leather. Use it in the same way as a grease gun, applying the cone point to the oil hole and pressing the end of the barrel.

OIL LATHE BEARINGS

While on lubrication subjects, lathe users who read these notes might be interested in the way I keep my lathe mandrels supplied with oil. My type R Milnes lathe has hardened-steel cones running in hardened-steel bearings, and if these ran short of oil it would be fatal.

This type of bearing is about the most accurate and long-wearing that it is possible to fit to a lathe mandrel —all the old precision lathes of Continental-make had glass-hard cone bearings, according to the late George Adams' catalogue—but it needs an oil film between the cones. To ensure this I fitted two commercial oil cups with central pipes and "trimmings," the principle being the same as that used on the L.B. and S.C.R. for axleboxes and horns.

Instead of a trimming made from copper wire and worsted (I can still make trimmings, swabs and mops !) I use pipe cleaners bent out of centre, the long end going down the oil pipe and the short end resting in the cup. When putting a fresh one in it is saturated with oil, and then all the time there is any oil in the cup it will syphon down to the bearing—very slowly so that one cupful lasts a long time, but ample to maintain the film necessary for proper lubrication. I use the grade of oil recommended by the oil companies for high-speed machinery.

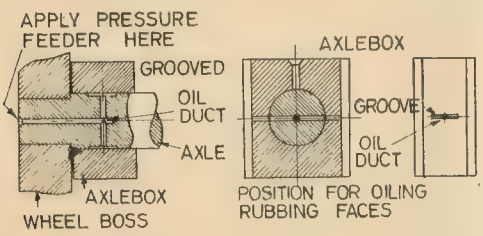
My Boley lathe has a cone bearing at the nose end of the mandrel and a parallel one with ball thrust and hardened adjusting collars at the tail end. When I first had it in 1930 it had two plain brass oil cups with lids and very small holes at the bottom of the cups to let the oil seep through. To make the feed adjustable, I drilled the holes out and fitted two 8 B.A. screws, the threads being filed partly away at an angle, so that when the screws were right home the feed was shut right off.

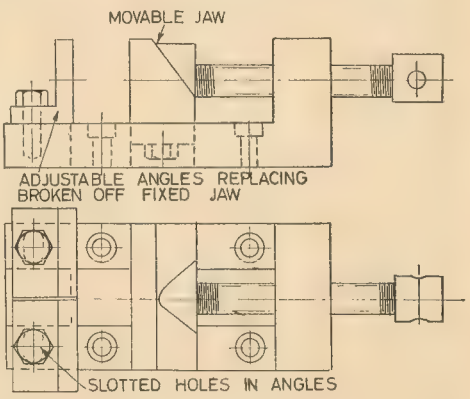
As the screws were turned, the filed part of the threads was exposed and oil could then pass, the flow being easily regulated by the amount of "flat" showing above the bottom of the cup. I found the right amount by experiment, and have never had occasion to alter the adjustment since. I use this lathe more than any of the others as it is ideal for fittings and all small work. There isn't a vestige of shake in the bearings, so there can't be anything wrong with the lubrication.

Incidentally, I have just treated it to

Right: Broken machine vice adapted as a face-plate chuck

Left: How to oil axle-boxes and horns from outside





Tricks of the trade

a new motor, a G.E.C. quarter-horse repulsion-start type, as I was unable to get any much-needed spares for the original motor of another make, and have no time at the moment to make any or overhaul it.

The Myford Super 7—I call it the "supersonic" on account of that top speed of 2,100 plus !—has a sight-feed with screw regulation at the nose end of the mandrel. But the tail end only has a nipple which needs the application of the oil gun, and the belt cover has to be lifted for this. I don't like stopping on a job to oil up, and, of course, there is always the possibility of overlooking things, so I replaced the tail-end nipple by a small elbow fitting with a pipe attached, filing a clearance in the belt cover for the pipe.

On the end of the pipe I fitted an oil cup with syphon pipe and trimming, so that it gets a constant supply, and now my conscience is clear. As I sometimes accidentally alter the adjustment of the sight-feed gadget or forget to turn it off when finishing a job, causing oil to be sprayed from the bearing over my face and overall next time I start up, I am fitting a trimming to that also. Then I shall be all set.

LUBRICATING DRILLS

Everybody knows that for turning iron and steel, a supply of lubricant or coolant to the cutting-tool is a necessity for easy cutting and nice finish—and the idea of fitting a can with a pipe to allow cutting-oil or other fluid to flow on to the cutting edge of the lathe tool is as old as the hills. When drilling holes in iron and steel on a drilling-machine, it is equally important to supply cutting-oil to the lips of the drill. But from what I see and hear very few take the trouble to rig up a can and pipe on their drilling-machines, relying on a dab of oil or other fluid applied with a brush when the cut is started and leaving the rest to fate.

I fixed up cans with regulating cock and pipe on my pillar-drill, vertical milling machine and horizontal miller. On the two former all it required was a tin clip soldered to the side of the can. On the drilling-machine this clips on to the pillar; on the vertical mill to a projection at the side. In each case the pipe can be adjusted, so that the cutting oil is delivered at the end of the drill flutes, and then runs down the drill to the cutting edges, or, in the case of the milling machine, to the spindle of the cutter whence it runs down to the "scene of action." The result is that I get clean holes or finished surfaces, and seldom have to grind drills or cutters.

The oil can on the horizontal miller has a bottom clip which can be snapped over the overhanging arm, and the pipe is adjusted to drop the cutting oil on top of the revolving cutter, the rate of supply being adjusted by an ordinary plug cock.

Not essential

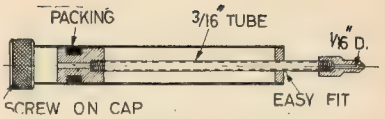
As I only use the Boley lathe for small jobs a constant oil supply to the cutting tool isn't essential, a brush being quite all right for turning side-rod pins, brake-gear pins, screwing and tapping in iron and steel, and so on; but for saving time the brush and can should be handy and at the same time out of the way when not in use.

As there is a small tier of shelves right behind the machine, I fixed the can on the end of a small gallows arm bent up from ¼ in. steel rod, the end resting in a socket bent from sheet brass and screwed to the edge of one of the shelves. When the gallows arm is at right angles to the shelf, the can is right opposite to the lathe chuck and handy for use, especially when drilling and tapping work in the chuck or using a die in the tailstock-holder on screwing steel. When finished, if the arm is swung back against the shelf, it is right out of the way and it is impossible to knock the can over. Only a simple and trivial thing—but the time saved is amazing.

Another time-saving trick I did was to drill some holes in the thickness of the shelves. In these one can put centre drills, pin chucks, odd drills and cutters—in fact anything frequently used when working on the lathe. You don't have to stop and look for anything needed—it is right there looking at you instead, and if put back in the same hole when finished with, you know where to find it next time it is required.

A HOME-MADE UNIVERSAL CHUCK

Most locomotive-builders are familiar with the small type of vice which can be used as a machine vice or attached to a swivelling stand and used as a light-bench vice. The sliding jaw is fitted on two light runners, the fixed jaw being a casting at the end. Well, some years ago a friend who owned one of these put a little too much "Sunny Jim" on the screw when tightening up, and broke off the fixed jaw. He asked me to weld it on again, but I showed him a trick worth two of that, and with a little jerry-wangling and a couple of pieces of angle, he converted the broken vice into a first-class universal chuck.



A simple oilgun-type feeder

The ends of the runners were filed off square and a distance-piece put between them to keep them parallel with a bolt through the lot. The pieces of angle were nicely squared off and each attached to a runner by a setscrew, in such a way that they could be set in line, in which case they served the purpose of the original fixed jaw at the end of the runners—or they could be set at any angle relative to each other so that they could hold an irregular-shaped piece of work without any packing or any risk of slipping. When this arrangement was bolted to the lathe faceplate, using the original holes in the runners, the combination of faceplate and vice became a universal chuck capable of holding anything within its capacity, no matter what shape it was.

I make no claim for this idea, as it is an adaptation of the principle of a small machine vice given to me "for services rendered" by an esteemed friend. This vice was made by an American firm and is known as Jerrim's patent "Fixie" vice; I have never seen another in this country, neither have my few personal friends who envy me its possession. ▣

VIRGINIA PLANS

THE seven sheets of *Virginia*, the 3½ in. gauge old-time American locomotive whose construction was recently described by L.B.S C., are now ready.

The plans are 40 in. × 28 in. and each contains a great deal of detail and costs 7s. 6d. ($1.50). The main contents are:

Sheet 1: Arrangement side view. Engine frame, truck frame. Springs, springing post. Coupled wheels, truck wheels. Axles, eccentrics. Coupling rods, crankpin.

Sheet 2: Walschaerts gear. Cylinder. Connecting rod. Eccentric rod. Reversing shaft. Guide yoke. Eccentric strap and rod. Reversing gear details.

Sheet 3: Boiler. Alternative boiler. Lubricator assembly and details. Reversing gear and details. Pump cylinder.

Sheet 4: Superheater and throttle. Smokebox for straight-top boiler and smokebox for wagon-top boiler.

Sheet 5: Cab and fittings. Cowcatcher dome. Pipe layout, water-gauge, blowdown valve, safety-valve, cab deck and bypass valve. Boiler joints. Grate and ashpan check. Steam valve.

Sheet 6: Tender, tender truck, wheel and axle bell. Headlamps. Smokestack blower and snifting valve. Whistle injector.

Sheet 7: Tender, tank and fittings, brake gear, and miscellaneous details.

The swing-clear boring toolholder—3

In conclusion MARTIN CLEEVE details the machining of the holder body and offers hints on forming corner radii

Continued from 16 May 1957, pages 709 to 711

I ALLOWED the body to form the subject of the concluding article in order to suit the convenience of those who perhaps have had to await delivery of a suitable piece of steel. But before dealing with this the milled toolholder has to be fixed to the assembled arms and spacer.

When making the second version of this holder I found that the most convenient method to adopt to ensure ultimate symmetry was to set-up as shown in the drawing (Fig. 10). Here the slotted toolholder *C* is securely clamped to the assembled arms, spacer and pivot *D* the whole being stood upright on the drilling machine table.

The clamp *S* depicts that to which I sometimes refer as the "bolt and strap type." I have several of these, but their convenience is enhanced when threaded studs are inserted into the lower bar or strap. It is often advantageous to be free of the projecting bolt heads: tightening is also facilitated as only one spanner is needed.

Letters *T* and *U* represent mild-steel blocks, *U* being of the thickness required ($\frac{3}{8}$ in.) to ensure the symmetrical positioning of the holder *C* which, before tightening the clamp, is made to abut against the additional block *T*. Having set and clamped thus the previously drilled holes in the toolholder *C* will serve as a guide to drill the arms to the appropriate depth shown.

As the clamp *S* prevents the drilling of the central hole, this may be attended to later. Therefore, having drilled each arm, remove the clamp, tap the arms, open out the two outer holes in *C* to $\frac{1}{4}$ in., counterbore (the slot-side—not the outside !) and fix to the arms. After re-checking for symmetry, etc., use the remaining central hole as a jig for drilling the spacer.

In theory, there will remain a wall thickness of 1/32 in. at the edges of the two outer counterbores for the $\frac{3}{8}$ in. screw heads; while progressively opening these out in the manner suggested in part 2, an eye should be kept on these edges. Should it become apparent that something has gone amiss and that a $\frac{3}{8}$ in. drill might break through the side, stop the counterboring at the 11/32 in. size and reduce the diameter of the heads of the screws to suit.

CORNER RADII AND CHAMFERING

While these operations can be carried out entirely by a hand saw and file, the process is apt to become somewhat tedious. It is, therefore, my practice to slit as much as possible under controlled conditions in the lathe. Fig. 11 illustrates the set-up used to chamfer the rear corners of the toolholder block.

In this case the block is temporarily bolted to an odd bar of steel which is held in a toolpost. Care should be taken to ensure that the work is vertically square to the slideways; such a sawn surface needs very little finishing to produce a reasonable blemish-free surface.

In the case of corner radii two cuts at 45 deg. close to the scribed line reduce filing to a remarkable extent. I always slit thus: hand-grind on an offhand grinding wheel provided with a suitable work-rest for the purpose and finally polish with a strip of carborundum cloth. This is pulled over the radii by holding each end in the hands, the work projecting at a convenient angle from the vice.

BODY AND BASE

To facilitate the machining of the body it will be best to prepare the base *B* (Fig. 12). Assuming this will be made from a sawn length of 2 in. × $\frac{3}{8}$ in. bright steel, tedious filing can be avoided by facing each end to length in the lathe.

A small piece of stock such as this base piece may be gripped quickly and satisfactorily by the jaws of the three-jaw self-centring chuck—one jaw above and two below. The ultimate

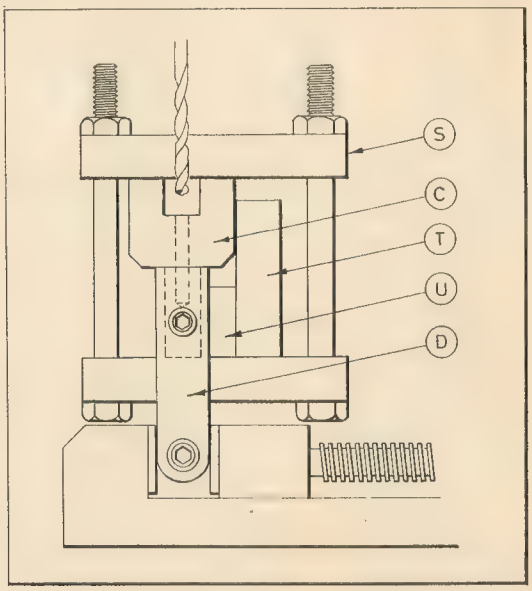


Fig. 10: *Method of using the toolholder* C *as a drilling jig for the arms* D

BORING TOOL-HOLDER . . .

squareness of the first end to be faced may be ensured by taking a sight along the lathe bed from a foot rule held against the side of the piece. Of course, heavy cuts must not be taken when work is held in this manner and with such overhang.

I should run the lathe at about 500 r.p.m. and take a rapid series of facing cuts not exceeding about two thou in depth, the cross-slide being free from any stiffness. In case of doubt the appearance will be improved if the length slightly exceeds that of the body—2½ in. Drill the two fixing holes tapping size for ¼ in. B.S.F. and ignore the ⅜ in. hole.

The bodies of my two holders were each made from a 1 in. length of 2½ in. square bright mild steel and each was tackled in this order; both sides faced to bring the piece(s) to a final thickness of about one thou less than the space between the arms —not forgetting that a final light filing and polishing will also remove about 0.001 in. With a little care it is possible to so adjust the thickness that the arms embrace the body with a slight frictional interference. However, this is not very important as the holder is normally used nearly at right angles; thus a slight lateral movement will not result in an error of cutting depth relative to the feed-dial reading.

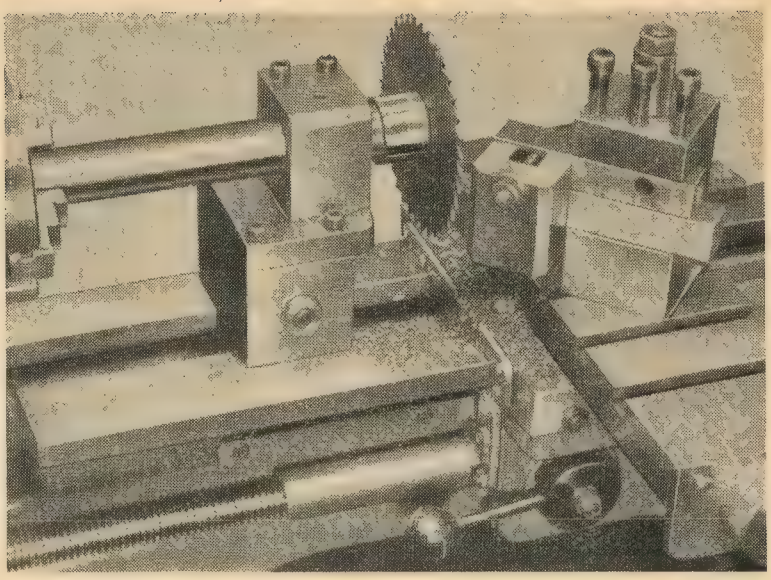


Fig. 11: *The set-up used to bevel the rear of the toolblock. The saw is* 4 *X* $\frac{1}{16}$ *in. H.S.S.; speed about* 100 *r.p.m.*

After this, an examination of the four sides of the block showed the two surfaces with the least blemishes. These were made to form the front and rear, while that which was to become the base was lightly skimmed prior to fixing the baseplate *B*.

The ¾ in. dia. hole for the arm pivot is at lathe centre height with the body *and* base standing on the cross-slide, and this hole may be machined easily when the assembly is held to the cross-slide by its own T-bolt. Please note that the centre line for this bolt hole is not on the centre line of the block, but $1\frac{3}{16}$ in. from the back.

Having centre-popped the position of this ⅜ in. hole on the top of the block, an initial drilling with a B.S. No 2 centre drill facilitated lining up, the block and base being held by the base in the four-jaw, and the tailstock centre used as a setting reference.

BORING THE PIVOT HOLE

It was important that this hole should be square with the body—so, after marking a vertical datum line ½ in. in from the back, the block (with base attached) was T-bolted to the cross-slide and squared by abutting one face against the jaws of a chuck. The cross-slide was then adjusted to bring the datum line coincident with the point of a centre drill, the slide locked by tightening the jib screws and the feed handle removed as a precaution against thoughtless fidgeting with it.

An initial drilling by stages up to ⅝ in. was followed by boring with an ordinary boring tool-bit held offset in the four-jaw chuck. With this method, by the way, the cut is "put on" by adjusting the chuck jaws. Those of you who have not tried this method of boring now have your chance because, at worst, an overbore will result only in your having to make another pivot pin to suit. Anyway in case of doubt keep the bore below, rather than above, the ¾ in.

Before sawing for the pivot bearing adjustment split, it was found convenient to drill and tap the adjusting

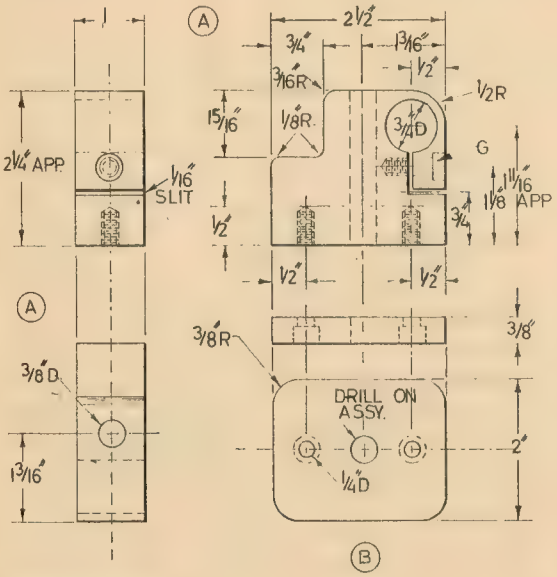


Fig. 12: *Details of the body* A *and the base* B

screw hole *G* (Fig. 12). Note that the height dimensions around this quarter *exclude* the base which, at this stage, is best removed. Drill tapping size for ¼ in. B.S.F., open out to ¼ in. clearing (letter *F* 0.257 in.) taking care not to drill more than a few thou beyond the line of slitting; tap and counterbore for the screwhead.

It will be seen that the actual overall height of the body *A* is determined by the positon of the pivot hole, the top of the body being ½ in. above the centre line of this hole. I simply held the block in the four-jaw and faced off the top to the required amount.

One of the slitting cuts for the pivot frictional adjustment may be made by the slitting saw. But, remember, the inner vertical cut calls for careful hand sawing.

I formed the front "step" by slitting after having drilled a ¼ in. dia. hole at the inner corner to give the ⅛ in. radius. Do not overlook the fact that the centre of this hole is only ⅝ in. in and 13/16 in. down.

FINAL NOTES

I once knew a chap who had fitted an adjustable height toolpost to his lathe. This post could be set for tool centre height by movement up or down a 1¼ in. dia. stem which was screwed into the topslide. There came a time when he required to set up an awkward job and, upon my suggesting that he removed this stem, he exclaimed: "Good heavens ! That will never come out." It was screwed up with 24-in. Stillsons !

He was suffering from a common delusion—that although the lathe was driven by only a ½ or 1/3 h.p. motor, the load on a cutting tool might, in some miraculous way, amount to the equivalent of several tons. Anyway, there is no need to tighten the screws on this holder in anticipation of a fully-loaded double deck bus being suspended from it ! Just use the key in the normal way. My holders are quite satisfactory though assembled with home-made mild steel socket screws.

I am including a picture (Fig. 13) showing the two holders in their final form. The one at the left is my own modified prototype and the right-hand one is that which I gave to a friend who has since given it a thorough test followed by an enthusiastically-favourable report. ▣

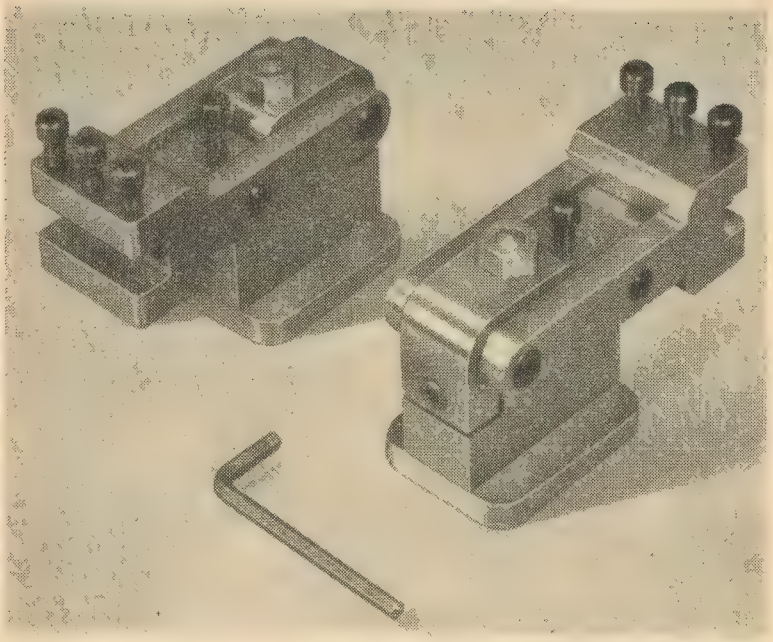


Fig. 13: *Two finished holders. Left: the author's modified prototype. Right: one for a friend*

BOOK REVIEW

MODEL ENGINEERING PRACTICE

by F. J. Camm (London : George Newnes Ltd). 235 pages, 7¼ in. x 4½ in. 272 illustrations. Price 17s. 6d.

SEVERAL books have been written on the various branches of model engineering and most of them have achieved their object to a greater or less extent but the subject is such a wide one that the claim made that this is "a comprehensive book covering everything from tools to processes" lays it wide open to criticism in respect of any omissions and deficiencies.

Although, as the author states in the preface, there is a vast difference between professional and model (amateur ?) engineering, the greater part of the book is devoted to a description of tools, equipment and processes which are equally applicable to either.

This is not necessarily a fault—one can never learn too much about the basic principles of practical engineering—but it does restrict the space which can be devoted to the specialised techniques of model making and examples of actual models; neither in number nor variety are these in fair proportion to the matters dealing with general practice.

Some very good chapters are included on the making of showcases for models, castings in soft metals, patternmaking, and making wheels for models—though the latter subject is one which many model engineers never or hardly ever encounter.

On the other hand, the all-important matter of prototype modelling is dismissed in a short chapter with illustrations of only three types of models. In other respects the book deserves praise for the profusion and quality of illustrations, and cannot fail to be useful to the amateur worker, though I do not wholeheartedly agree with all the advice given or the opinions expressed.—E.T.W.

FOR SHIP ARTISTS

HOW TO DRAW MERCHANT SHIPS by Leonard W. Sharpe. Published by The Studio Publications. Price 5s.

This is No 37 of the popular Studio "How to draw" series and is entered as volume 2, volume 1 by the same author having been published in 1945. On comparing the two volumes, one is impressed by the great development which has taken place in the design of merchant ships during the last decade or so and also by the necessity for producing an up-to-date version of the original book.

The book has been practically rewritten and the great majority of the illustrations are new. Modern designs in funnels, masts, and superstructures are all shown, and extreme examples of the streamlining of bridge and funnel structures are included. Useful and interesting details are given of derricks, anchors, winches, davits, and similar fittings, all of which will be valuable to the ship modeller. A new section deals with tankers, of which many fine examples have appeared during recent years. E.B.

A SIMPLE GRINDING MACHINE

Part two

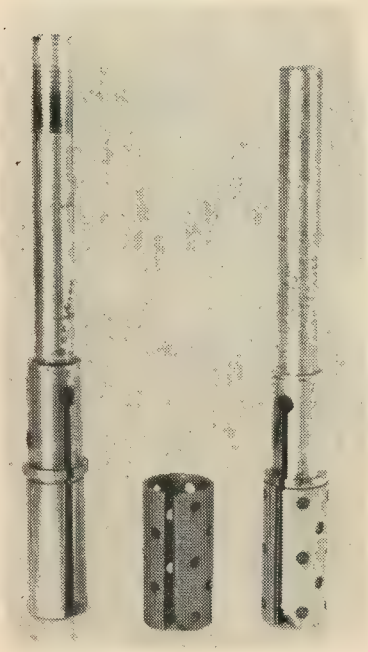


Fig. 9: A pair of internal laps

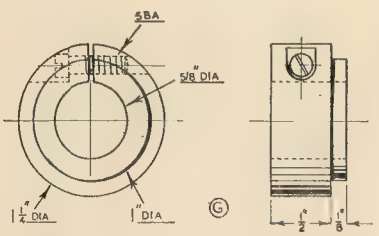
THE internal lapping of the bearings is carried out with a simple expanding lap similar to those illustrated in Fig. 9. The prototype is an American production known as the Boyar-Schulze lap. As will be seen, the tool consists of a steel shaft split for part of its length and provided with adjusting screws that allow the perforated copper sleeve surrounding the steel shaft to be expanded as required.

These American laps may now be difficult to obtain, but they are simple enough to make. The steel shaft is a straightforward piece of turning that is subsequently split by hand sawing or milling in order to provide the means of expansion. The perforated copper sleeve can be formed by rolling a piece of annealed copper sheet round the steel shaft, having first bent over a short length of the material and engaged it in the slot formed in the steel shaft. The perfect circular form needed can be obtained by passing the sleeve loaded on its shaft through a succession of holes in a drill gauge. By this means the sleeve can be quickly brought to size. As to the perforations, they are not absolutely necessary since the lapping compound is well retained by the slot in the steel shaft.

When using an internal lap, great care must be taken to make sure that the work does not become bell-mouthed; for this reason, the lap should be held firmly in the lathe chuck whenever possible, while the work itself is supported by the hand and allowed to "float" on the lap.

When the work is mounted—for example, on the lathe cross-slide—the lap should be driven flexibly by means of a rubber hose. In this way the lap itself will float in the work.

Lapping carried out by this method will not cause bell mouthing to take place. On no account should the lap be expanded too tightly or the work may be spoilt if the lap seizes up.



Left, Fig. 10: Details of the adjustment collars G

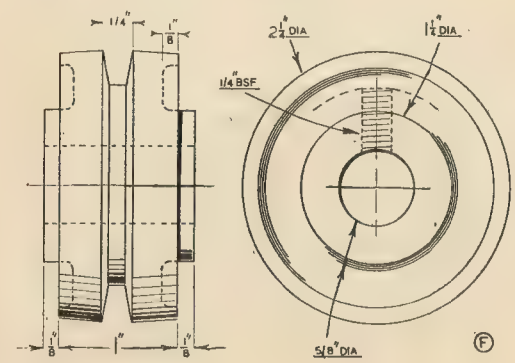
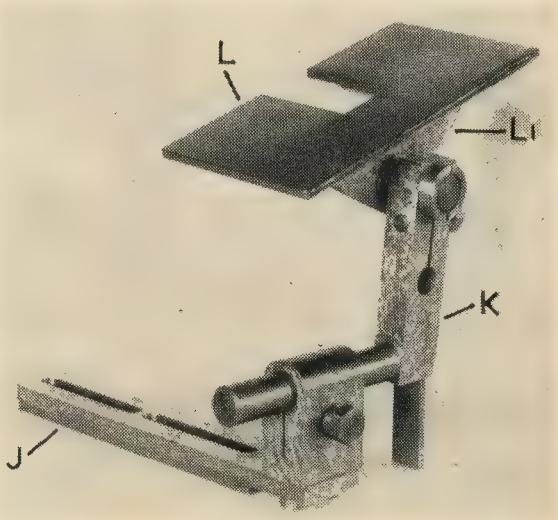


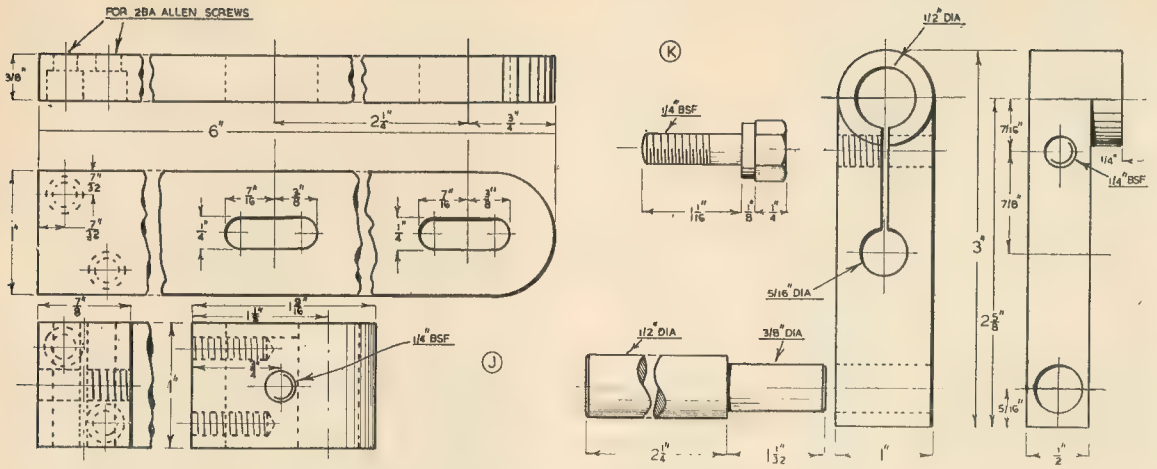
Fig. 11: Details of the pulley F

THE ADJUSTMENT COLLARS *G*

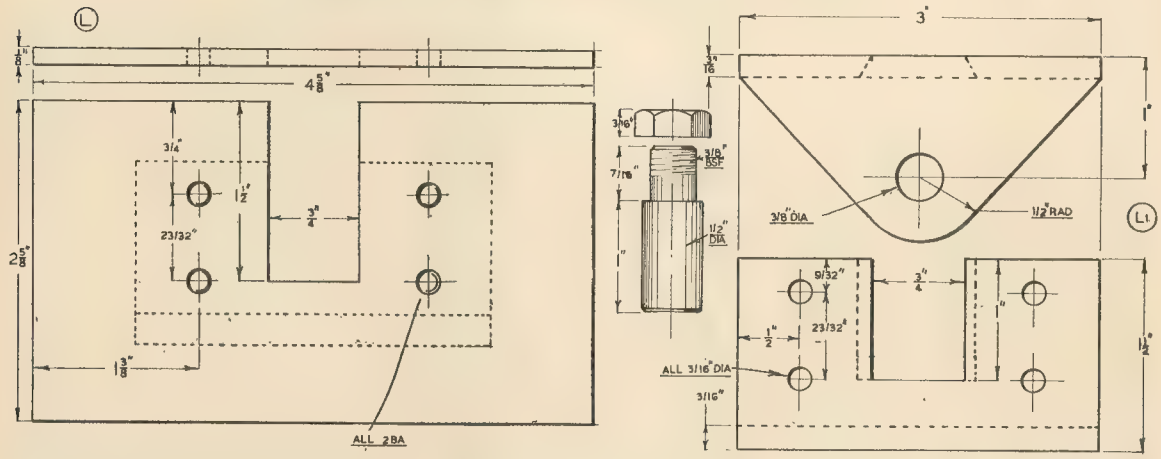
The adjustment collars *G* (Fig. 10) are similar to the many like



Right, Fig. 12: The work rest



Above and below, Figs 13 *to* 16: *Details of the work rest*



components that have been described in the past. These parts are made a firm sliding fit on the spindle *C* and are secured by means of a 5 B.A. screw which contracts the collar on to the shaft itself. The component is turned all over at one setting and is afterwards lapped before fitting to the spindle.

THE PULLEY *F*

The pulley *F* is turned from a length of round mild steel, being first bored to size and then mounted on a mandrel so that the pulley can be turned to size. The part is provided with a V-groove so that a round belt or a miniature V-belt can be used as desired. In addition, the width and crowning of the pulley itself enables a flat belt to be employed if necessary. The pulley, which is illustrated in Fig. 11, is secured to the spindle by an Allen grubscrew.

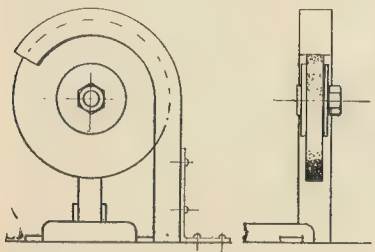


Fig. 17: *The wheel guard*

THE WORK REST

The work rest (Fig. 12) is of a type advocated in the past, in that it provides for setting the lathe tool to be ground at any desired angle. The rest consists of three parts, *J*, *K* and *L*.

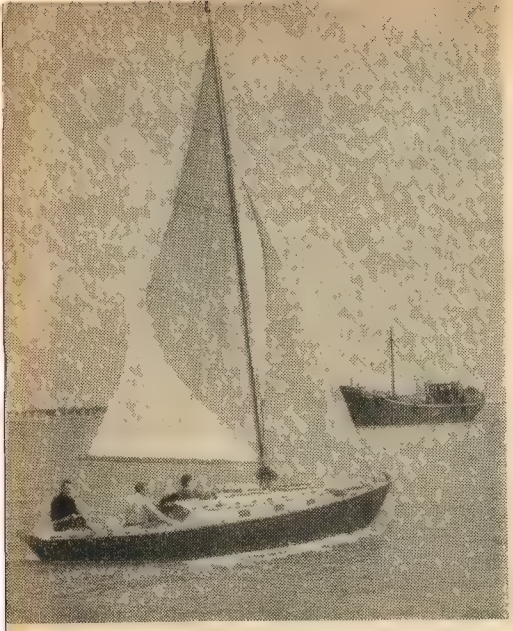
The base *J* consists of a length of mild steel having a clamp to secure the spindle of the vertical member *K* and the worktable *L* is secured to the vertical member by a spigot attached to the angular member of the worktable.

The detailed drawings (Figs 13, 14 and 16) will make the construction clear.

It will no doubt be noticed that the length of the vertical member is such that the height of the worktable surface is above the axis of the grinding wheel. For those who wish to grind on the side of the wheel this fact will be of little importance; but those who wish to use the periphery of the grinding wheel are advised to shorten the distance between the ½ in. and ⅜ in. dia. holes in the vertical member *K*.

THE WHEEL GUARD

The illustration of the complete grinding machine published in the previous article shows no wheel guard in place. Before running the machine a guard should most certainly be fitted. The pattern illustrated in Fig. 17 is quite suitable for the purpose; apart from preventing serious trouble in the event of the wheel bursting, the guard will do much to stop grit and metal dust from being thrown away from the machine when in use. ▣



A fine sail on the River Colne last year

To good account

One's skill with the lathe can often be put to some practical purposes, as this article by BINGHAM shows

I HAVE MET many kindred spirits among model engineers who do not always confine their activities to that alone. When not making a locomotive they "have a go" at something quite different. It may take the form of a radio or even an armchair in which to sit and ponder the next job. For myself there are times when boat building takes pride of place.

To those who say that this subject has little to do with a magazine devoted to model engineering I would point out that there are many parts which go into a small boat that can be made more advantageously by the model engineer.

For instance, most of the brasswork and metal fittings can be made easily in the home workshop from one's own patterns. The price of the same articles from a ship's chandler would be quite expensive and secondhand goods are seldom exactly what one wants, so replacements and future improvements are thereby simplified.

In the winter 1937-38 I built a 21 ft half-decker from a set of drawings but some modifications were needed to make her a bit more seaworthy on our open Blackwater estuary, for she had been designed as a Californian lake boat. I did very well with her in the club races in 1939 and I sold her in 1947.

In the years between selling the half-decker and building a cruiser, I constructed a lathe, several locomotives, numerous petrol engines and a microscope, but always the idea of another boat was in the back of my mind.

My latest job is a 24 ft four-berth sailing boat of Swedish design and after two seasons' use she is still an ideal boat. No modifications have been made to the hull or rig since she was launched. In the original plan she had only two berths and a mast stepped on the keel. Both interior accommodation and rig I re-designed to suit my requirements, that is, four berths and the mast stepped on deck to give greater comfort below.

With the exception of the keel, the sails and the mast track, I made everything here at home, including such things as stern tube, gland-shaft coupling and water strainers.

One item which merits a few words is the centre plate hoist which has to lift and lower a $\frac{3}{8}$ in. steel L-shaped plate weighing almost 1 cwt.

I designed a geared winch with a spring-loaded friction brake which is automatically disengaged when lifting and only comes into operation when lowering. This was necessary when the young members of my crew were called to "Up centre plate."

The other interesting job from the engineering point of view was the power unit; this was originally an army charging set, with a four-cylinder Coventry Climax petrol engine and after using it to drive a saw bench during the building of the boat it was converted to an auxiliary.

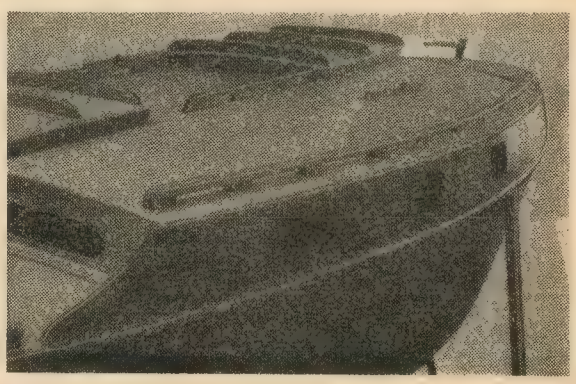
It is a well-known fact that a car or generating-plant engine is not too satisfactory for marine use owing to its high speed; and some have a lot of aluminium about them too.

Another problem was the very limited space available on board. Before the boat was planked up the cylinder block was stripped down and offered into place, measurements were taken and the sump cut off at an angle to just clear the keelson. The oil pump had to be shortened to suit; two large blisters were then welded on the sump sides to give a larger oil capacity. The magneto which was originally mounted above the cylinder head was given half a turn round and lowered some $4\frac{1}{2}$ in.

The flywheel had grooves for two V-belts; one of these I turned off and then shrunk a 12 in. steel ring over the other. It was made out of an old lorry flywheel, a three thou shrink fit being allowed and then pegged. All this was done to decrease the overall length of the engine and increase the weight and diameter of the flywheel. This helped to bring the running speed down and make it possible to install the engine 1 in. farther forward. Quite a lot when you haven't got much room to spare.

A cooling water pump was made out of odds and ends from the scrap-box. It is the inverted plunger type with disc valves, springs and filters, all easily removable for cleaning. The

Top: BLUE TAIL *moves easily to a gentle breeze*



Right: *The cabin midships section. Note raised top-sides*

drive was taken off a small pulley attached to the flywheel.

A centrifugal clutch was bought and married to the crankshaft. An overhead starting handle, shaft and copper exhaust completed the job. It was, however, found to be rather noisy so this year I made and fitted a three-chamber water-cooled copper silencer.

The engine gives about seven knots flat out. The petrol consumption is high at that speed and I rather suspect that at that speed cavitation takes place. A steady five knots burns just about half a gallon per hour, which is reasonable.

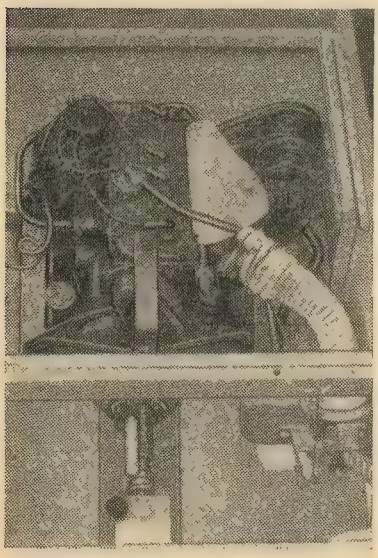
Overcoming the various problems and snags on a boat of this size taxes ones ingenuity to the utmost when working single-handed; not the least of these is the weight and size of some of the parts, especially the keel. This piece of cast iron was 9 ft long, 7 in. thick at its maximum, × 12 in. deep, and it weighed 11 cwt.

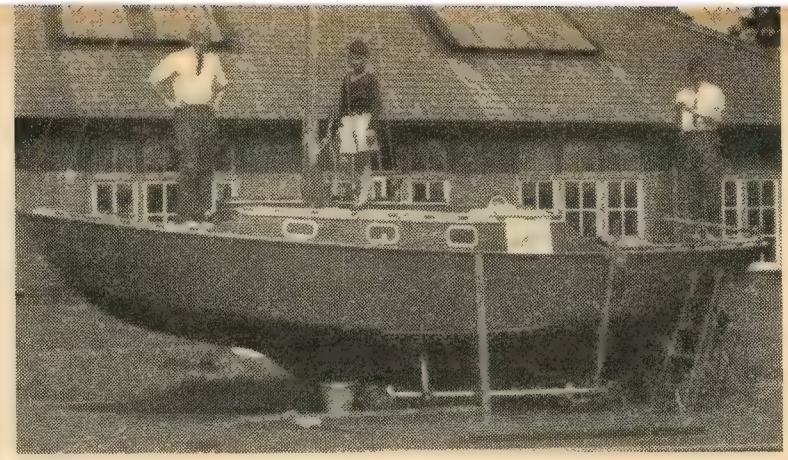
My chief assistant during the building was my 11-year-old son, who cheerfully mixed up large quantities of glue, fixed clamps, swept up and I rather suspect sometimes got a little concerned about the size of the job. My daughter who was only 10 at the time came in for lots of sand-papering and painting—not all of the latter going on the boat.

To handle and move with safety a boat 24 ft × 7 ft 3 in., standing 7 ft 6 in. tall and weighing two tons deadweight, calls for a good deal of thought.

There are two ways of doing this, and both can be costly. The first is to have a gang of experienced boatyard hands used to the job and get it done as quickly as possible; the other is to have a little help, and a lot of tackle. I chose the latter simply because of the distance we were from the coast, and there was no local help experienced in this work.

The Coventry Climax engine fitting snugly in its compartment





The yacht almost ready for her first sea trials

So with some lengths of 1½ in. dia. piping and some Kee Klamp fittings I made up a cradle strong enough to carry the boat. Four cast-iron wheels, four stub-axles and a hydraulic jack completed the gear. With this set-up the boat could now be moved both forward or backwards.

By jacking up the for'ard end and removing the wheels and stub-axles from the side-pipes, and by fixing them in the pipes running fore and aft, I could now slew the bows from side to side and by doing the same thing down aft, the whole boat could be moved sideways so that complete manoeuvrability was obtained.

Until this time we had no idea what to call the boat. However, a fellow model engineer decided for us; it was Mr W. G. Dennis whose two-saddle tank locomotives are well-known to many. He asked how long the job had taken so far. When he was told 10 months, he remarked: "You must have worked like a blue-tailed fly." The name caught on and it was for that reason we chose blue as the colour. She was started on 22 July 1954 and launched complete on July 14 one year later.

Some snags were encountered getting it to the coast on a low loader. She was launched down the beach on two planks still sitting in her cradle. The tide was out so we had to wait until she floated off. After priming the pump the engine was started and off we went. I never shall forget that moment. In the excitement we forgot to have a drink on board to celebrate—a "dry" ship indeed.

During the summer I built a 20 ft trailer to bring her home at the end of the season. This was made out of two lorry front axles. The Ackerman steering on this proved an interesting job, a bit big for model engineering. An oxy-acetylene welding plant was borrowed for most of the work.

Even after last year's abominable summer, I feel the effort was well worth while. The youngsters have both learnt what self-reliance means and my poor long-suffering wife has been called upon to do many things she never thought possible.

It is true that there is nothing that gives confidence more than to be in a boat out on the open sea. Our worst experience was on 29 July 1956 during a freak gale when we had to stay aboard 46 hours unable to do much about it. ■

The author's ORANGE BOX *which is very seaworthy*

READERS' QUERIES

Do not forget the query coupon on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20 Noel Street, London, W.1.

Tension springs

I am experiencing great difficulty in securing delivery of tension springs, and I propose to produce them by using the screwcutting gear on an ML7 lathe, and winding on to a double-split mandrel. If you consider this a practical proposition, could you please give me some indication of the heat treatment that would be required for the springs? These would be some 2 in. free length, $\frac{3}{8}$ in. o.d., possibly 18 s.w.g. wire, giving a tension load of 25-30 lb. at 3 in. extended length.—A.H., Rainham, Essex.

▲ *There should be no great difficulty in making closely-spaced springs on the lathe unless very specially high duty is required of the springs, which would call for the use of special steels and methods of tempering. It is quite a simple matter to wind tension springs without utilising screwcutting gear or a divided mandrel, as the elasticity of the wire usually releases it quite easily from a solid mandrel.*

The material generally employed is piano wire, which is obtainable in a tempered condition and requires no further heat treatment. Most spring manufacturers use pre-tensioned spring wire, though the composition may vary. Hardening and tempering springs after winding are generally very difficult owing to the delicacy of control required.

If you wish to have springs made to order, Pocklington and Johnson Ltd, 111 Clerkenwell Road, London, E.C.1, should be able to guarantee fairly early delivery.

Grinding wheel

I have recently purchased a single-ended grinder and would like to know the most suitable grinding wheel for general sharpening of high-speed steel drills (mostly $\frac{1}{4}$ in. and less) and lathe tools $\frac{5}{16}$ in. square. The speed of the motor is 3,000 r.p.m. and the diameter of the wheel for which it is designed is 3 in.—A.B., Walthamstow, London.

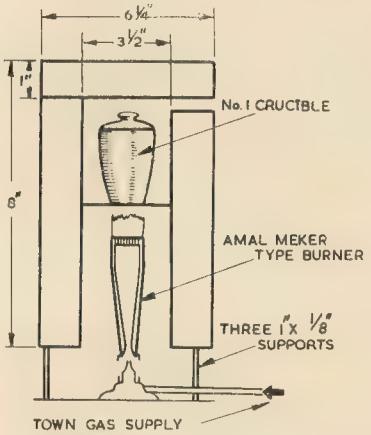
▲ *One of the following wheels would be suitable for work of this nature: Aluminium oxide; grit 36-40; grades MN, MO, MP.*

Should difficulty be encountered in obtaining these, carborundum wheels of the same specification would be satisfactory.

Heat source

I have recently been trying my hand at some casting, the set-up being illustrated in my sketch.

I find that I can melt aluminium (scrap pistons) in 15 to 20 min. from cold and 10 to 15 min. on second heats—but so far have failed in all attempts with brass or bronze. As I wish to operate indoors, I do not want to use coke. Can you suggest modifications to the existing burner or, alternatively, a type suitable for home construction which will reach a high enough temperature to melt bronze



The gas-heated furnace as suggested by H. O. of Chester

in a reasonable time, say, half-an-hour?

Finally, will aluminium or its alloys be suitable for use as a steam cylinder block under moderate steam conditions?—H.O., Chester.

▲ *Your particular type of burner will not produce a sufficiently high temperature for this purpose on natural draught alone. The Meker type of burner is, however, adaptable to the application of forced draught. It could be produced by means of a small fan blower connected to the ring of air inlets on the base of the burner—and this would give a much more intense heat.*

It might be found necessary when using forced draught to increase the size of the gas jet in the burner. Your sketch suggests that the furnace or muffle is built up from fire bricks; this is quite satisfactory provided all possible means for insulating it and conserving the heat are provided.

As to the use of aluminium or its alloys for steam-engine cylinders, the use of these metals for working parts in contact with steam is not recommended. But it would be quite in order to use an aluminium cylinder block with a bronze or cast-iron liner.

Aluminium alloys used for pistons generally have somewhat better properties at high temperatures than the more common alloys, though they are unsuitable for use with superheated steam.

Remedy for porosity

I am overhauling an engine, and, upon stripping, find that the cylinder block has developed a rather odd kind of porosity on one side. This porosity allows a minute seepage when the jacket is filled with water. However, it does not in the least affect the running of the engine—the cylinder bores are excellent—and as the engine is otherwise satisfactory I do not want to get involved in an expensive welding repair which would probably distort the bores and make reboring necessary. Is there any reasonably cheap and simple way out?—L.H.T., Witley, Surrey.

▲ *A cheap and effective repair could be obtained by means of a plastic composition. There is a process operated commercially for impregnating porous metal under heat and pressure which gives a very high penetration and can be entirely guaranteed. If you are interested in this get in touch with Industrial Impregnations Ltd, 9 Willow Road, Poyle Estate, Poyle Road, Colnbrook, Bucks, who will be able to give you further information on the matter.*

It is, however, possible to make a fairly effective repair without dismantling the block by the use of a plastic filler, such as Bondafiller, manufactured by Bondaglass Ltd, 40a Parsons Mead, West Croydon, Surrey, or by a resin cement such as Araldite manufactured by Aero Research Co. Ltd, Duxford, Cambridgeshire. The latter is applied by heating the block, with a blowlamp, say, to liquefy the resin—and further heating of the resin after application will permanently harden it in place.

A ¾ in. SCALE DOCK SHUNTER

By P. L. Frost

MY FIRST ATTEMPT at model making occupied my spare time for about four years, and involved building a ¾ in. scale model of British Railways ex-Great Eastern class Y4 0-4-0 dock shunter, first introduced in 1913.

It is a very powerful type for its size, with a very short wheelbase, and it is fitted with wooden block buffers to avoid buffer-locking on sharp curves. It may be seen at work in London Docks today, albeit somewhat altered in appearance and not for the better, by the cutting down of chimney, dome and cab.

I started it while serving my time in Stratford Works, the birthplace of the prototype, and so I was able to get a copy of the original drawings, which came in very useful.

All the turning had to be done on a small 1⅝ in. lathe and a little wangling and a lot of patience were needed in dealing with the bigger items such as cylinders and wheels.

Cylinders 1 1/16 in. × 1¼ in. and pistons are of gunmetal, as are the axle-boxes which run in hornblocks of hard brass. Motion is of mild steel case-hardened where necessary. Big-ends, side-rods and eccentric rods have split brasses fitted with gibs and cotters.

The feed pump, ½ in. bore, is eccentric-driven from the leading axle and a lubricator of L.B.S.C. design takes care of the oiling.

The boiler, of copper, 11¼ in. × 3½ in., has a Belpaire firebox and contains seven ⅜ in. tubes and two ¾ in. superheater flues. It was brazed by the aid of a five-pint blowlamp and two pairs of hands, assisted by a little locomotive language. A dropping firegrate 3 in. × 2½ in. is fitted. A hydraulic test of 200 lb. was passed satisfactorily, working pressure being 90 lb.

Side tanks are of hard brass and the left-hand one contains a hand feed-pump at the front; the coal bunker at the back opening into the cab. Sandboxes act as siphon oilers for the piston rods.

It was quite a job to capture the authentic A. J. Hill look for the chimney, dome and safety-valve casing, but the result I feel is not unsatisfactory.

Combined steam and hand-brakes with compensating gear are fitted. The cab has sides, roof and back made in one piece, easily removable for driving.

First steam trials were very disappointing. The engine slipped badly and the steaming was poor. In fact the pressure would drop from 90 lb. to 30 lb. in a single trip on the 80 ft straight track.

Experiments with different fuels and various sizes of blast nozzle having failed to produce any significant improvement, I was at length driven to the conclusion that the engine was over-cylindered in relation to both adhesive weight and boiler capacity.

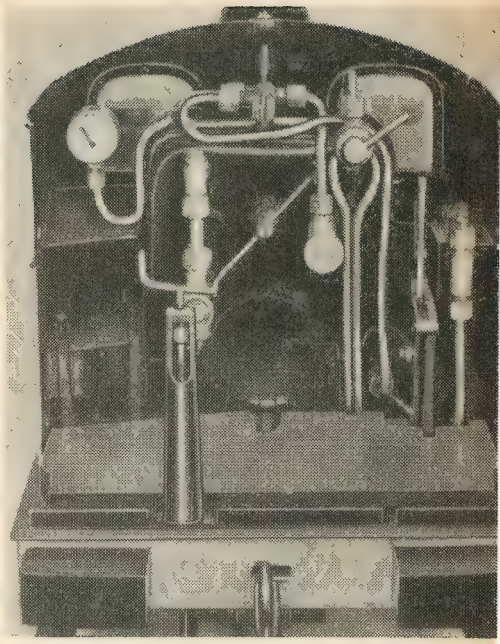
So I lined up the bore to ⅞ in. and also lengthened the exhaust cavity of the valve to reduce compression. The results were spectacular. The engine no longer slips, she steams well and runs freely. She has pulled a human load of 5 cwt plus a heavy bogie truck.

Although brought up in building the "big-uns" I must say I have found L.B.S.C.'s articles and tips a great help. And by the way—his steam-driven blower for starting the fire is well worth making—it saves all that monotonous pedalling on the foot-pump.

In conclusion, a word about the track. I wanted something strong, weatherproof and cheap. So I got some hollow concrete building blocks 18 in. × 9 in. × 6 in., stood them on end, 4 in. in the ground and 2 ft apart, with their sides butted hard against the edge of the concrete garden path.

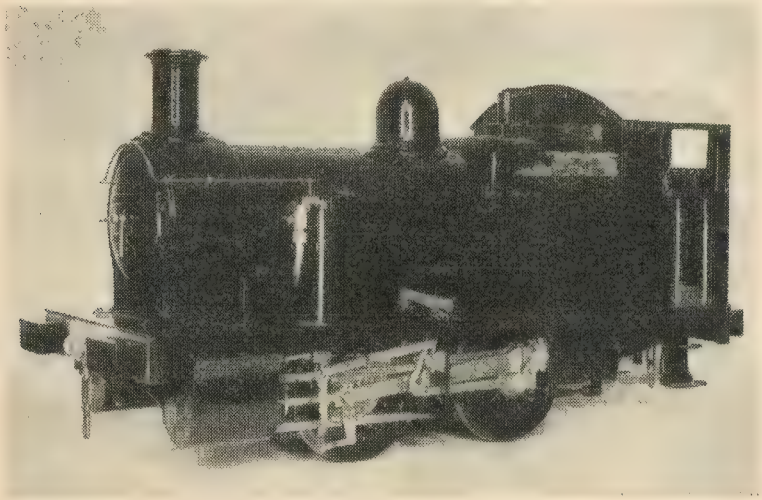
The rail is 1 in. × ¼ in. mild steel, with ¼ in. round tie-rods at 1 ft intervals fastened to the block by hook bolts. A piece of roofing felt acts as a pad between rail and block, reducing noise and improving the riding.

This track has now been in use for three years and shows no signs of deterioration. It is very strong and the cost was no more than 1s. 3d. per foot. ■



The fittings of the cab

Side view of the sturdy model shunter



POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

HOW CLEAN THEY WERE!

SIR,—As a very old reader of MODEL ENGINEER I should like to express my appreciation of the J.N.M. articles on "Locomotives I have known."

My two favourite lines were the old L.B.S.C.R. and G.E.R. upon which I travelled as a schoolboy, going from the South Coast to Suffolk. I shall never forget how clean and bright the engines were kept and their beautiful colouring and finish.

I was going through some old papers recently and discovered a photograph of the L.B.S.C.R. engine *Goldsmid* and found that it was an 0-4-4 tank engine. The date of building was not stated but it was probably 1895. Is it possible that there was another locomotive named *Goldsmid*, for the one you show is a 4-4-0 tender engine.

I always admired the G.E.R. No 10. I used to see this class pulling out of Liverpool Street in the 1900s. They were very smart looking and for their period did excellent work. I feel that they should be included in J.N.M.'s choice.

Freshwater Bay, Isle of Wight. C. R. SLAUGHTER.

MY TUG 'PEGGY'

SIR,—The picture shows my tug *Peggy* which I have steamed about the Round Pond on Sunday mornings for the last two years. I have thoroughly enjoyed it, as have the crowd standing around. I put on a device to sound the hooter every four minutes which makes it a little distinctive.

Unfortunately I can't run it any more as I had a stroke and am now disabled.

The power plant is the usual centre-flue boiler, blowlamp, $\frac{3}{4}$ in. × $\frac{3}{4}$ in. vertical engine. She has a slow speed feed-water pump and once I get steam up she will run two and a half hours without any attention.

Angmering, Sussex. W. J. STEVENS.

The tug PEGGY *which used to provide Sunday morning entertainment at the Round Pond*

EXTRA-LINE SWITCH

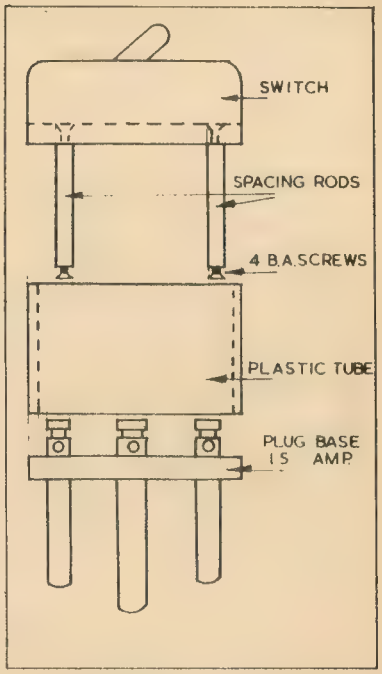
SIR,—L.B.S.C.'s remarks on steam raising [MODEL ENGINEER, March 21] prompt me to send details of a device I use to obtain an extra switched line from either a plain or switched socket.

The materials needed are one on-off switch, one plug, 15 amp. (round plugs and lighting switches have fixing and cover holes which line up), one 1 in. length of plastic tubing to space switch and plug base, the cover of which is not needed, two brass rods 1 in. plus $\frac{3}{16}$ in. tapped 4 B.A. each end, and four 4 B.A. screws.

The holes of the 15 amp. plugs and switches line up and the tube is gripped tightly between the two with the rods and screws. If the two are not of this rating a wood or plastic spacer will be needed and this will have to suit the two parts to be used.

The main idea is to space the plug and switch so that the line can be broken in the plug itself.

Warter, Yorks. E. RUDD.



Exploded view of extra-line switch

TRACTION ENGINES

SIR,—I was interested in the account of Foden and Burrell engines of the Nineties [MODEL ENGINEER, April 25] but the statement that after the advent of the single-crank compound Burrells abandoned the building of two-crank compounds is not correct; they built many two-crank engines right up to the 1920s.

The drawings of the springing systems interested me also, but I was sorry that further particulars were not given of the Aveling gear shown. I do not see in what way the position of the coiled springs differs materially from that shown in the early Burrell. What does differ is the fact that the final gear wheel appears to revolve on a hollow stub fixed to the hornplates, within which the axle rose and fell without disturbing the gear.

How was the compensating gear arranged, as none is shown in either engine? In the case of the early Burrell it was no doubt inside the winding drum on the left and drove the left-hand wheel direct and the right-hand wheel through the rear axle, but in the Aveling engine it is not at all clear how it was arranged. In fact, as drawn, it does not seem possible to apply a compensated drive.

It is interesting to note that Fodens, at this time, used a springing arrangement very similar to the early Burrell but with the springs at the top instead of below, also that later Burrells had to modify their design when they adopted the very sound idea of double gearing to the last motion with the compensating gear on the countershaft.

Norwich. GEOFFREY K. KING.

BOTTLED BUTANE

SIR,—I had considerable experience of bottled butane during the war and encountered your correspondent's freezing trouble [Readers' Queries, April 25]. This is due primarily to the high rate at which the liquid butane is transformed into gas.

I tried enclosing the cylinder in a base through which exhaust gas was passed but found this ineffective; it can also be very dangerous as a high pressure in the cylinder may result.

I cured the trouble by passing the gas through a copper tube wrapped two or three times round the exhaust manifold on its way between the pressure reducing valve and the mixing valve on the engine.

Buxton, Derbyshire. S. SCOTT.

SIR,—Your correspondent S.R. probably refers to the freezing of a calor gas cylinder due to an excessive rate of evaporation. I believe that this gas freezes at 1 deg. F. and, therefore, a cylinder 12 in. dia. × 18 in. high is quickly rendered ineffective.

If two such cylinders are coupled together with the special pipe which is available, about 15 to 20 miles can be run by a 1 to 1½ litre car before the evaporation rate is reduced too much. If two cylinders are placed in the closed car boot on the top of a shallow water tank connected to the cooling system continuous running should be possible.

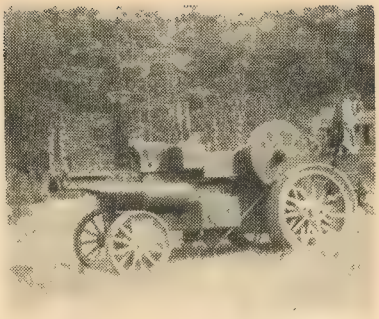
If the induction system is reasonably efficient 120 miles or more should be obtained from the contents of one cylinder.

Altrincham, Cheshire. J. STEBBINGS.

ECONOMICAL HEATER

SIR,—The other day I had to call at a local garage and while speaking to the head mechanic I heard a subdued roaring coming from the boilerhouse. On questioning the man I was told it was an oil burner, and I was invited to have a look at it.

Instead of a very expensive piece of machinery burning expensive fuel oil, I found a home-made contraption made for a few shillings. It was consuming old sump and gear oil.



This 2 in. scale model of the showman's engine THETFORD TOWN *is being built by Mr E. Baigent of Windlesham village, Surrey*

The boiler was really putting out some heat, the pipes on the return being very hot, and what is more the burner was only half on and was reputed to be using one gallon per hour.

Here is a description of it. A piece of tube about 3 in. long was screwed into the firebox door in the centre, the outer end having a blank end through which a piece of $\frac{5}{16}$ in. tube with a fine hole at the inside end was fitted. In this case it was the nipple off a greasing point on a car, with the non-return ball and spring removed. This thin $\frac{5}{16}$ in. tube was connected to the compressed air supply.

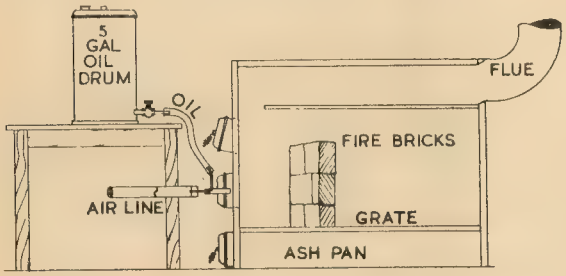
The oil was fed into the large tube, at a position just in front and above the air jet, through another grease nipple just a little opened out. Fuel was fed by gravity from a five-gallon drum fitted with a tap.

About 16 in. to 18 in. inside the firebox was a little brick wall of firebricks arrange in a semicircle to form a refractory combustion chamber.

To light the burner, a piece of oily rag is placed in front of the brick wall and lighted, the air and fuel turned on and away it goes.

Anyone with a spare motor of about ¼ h.p. and an ex-Government B.T.H. air compressor (or any other small compressor that would give a steady 40-60 lb.) could make such a device.

Keighley, Yorks. C. MAUDE.



Details of the home-made oil-burner unit

THREAD CUTTING

SIR,—The idea put forward by G. Brown of West Bromwich [Postbag, April 25] is quite sound. I have used it to cut 24 t.p.i., four-start, i.e. six per inch lead threads on approximately $\frac{7}{16}$ in. dia.

Interference difficulties can be minimised when cutting threads of steep helix angles by reducing the thickness of the cutting edge of the chaser to a minimum.

A further difficulty is that caused by the necessity to provide a clearance groove equal in width to the lead of the thread being cut if one desires a well finished thread.

Northfleet, Kent. A. H. J. CROSS.

MEMORABLE RUN

SIR,—Referring to the anecdote in Mr Maskelyne's article on the L.S.W.R. T-6 class ["Locomotives I have known," April 18] : when returning from Ilfracombe on the *Atlantic Coast Express* in 1932 engines were changed at Salisbury, we were already over half-an-hour late and the oncoming driver had a lot to say about being sent to London at that hour.

However, he and his King Arthur duly started. Our compartment was at the leading end of the coach and immediately ahead was an unoccupied guard's compartment, so Billy and I took the two "bay-window" seats and could see things.

As we passed each station there was whistle popping and much gesticulation from the engine crew evidently for a relief engine. Speed was high, but there was no shortage of steam though the vacuum gauge kept dropping back till the brakes could just be felt when full vacuum would be restored. However, this caper soon stopped and nothing further took place till we pulled up at Basingstoke.

We got out to watch events. There was a strong smell of burnt tallow and the driver shouted, "Hot box." The engine was uncoupled drew ahead, set back as soon as he got the road and went off hell for leather back to Salisbury—no attempt being made to do anything with an oil-can.

We sat there for over half an hour watching up expresses run through but with never a spare engine in sight till at last one appeared with a goods train and ran into the yard about half a mile away.

This turned out to be an Adams 4-4-0 with 7 ft 1 in. drivers (number forgotten) and the engineman, a dear old chap, clean shaven but with a fringe of whiskers around his face and wearing a bowler hat, said he would take us up to London, and he did too, non-stop! And didn't lose any time. A large number of the

POSTBAG . . .

passengers thanked him and gave him a tip.

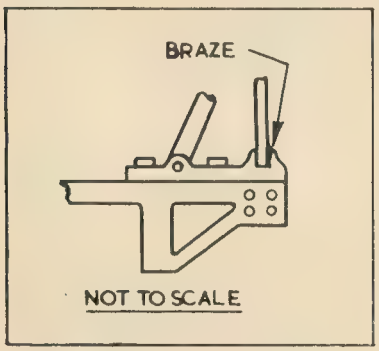
We arrived an hour and thirty-five minutes late; I am quite certain from the reception we got en route that word of what was taking place had been passed on. Woking and Nine Elms both turned out in force to wave and give us a cheer.

Braintree, Essex. W. BARNARD HART.

L.B.S.C.'s NEXT

SIR,—I was interested to see that Mr Bennet suggests L.B.S.C. should bring a small-size Prince to life as I have worked for some weeks as voluntary fireman on this engine and have been thinking of building a 3½ in. gauge version, but have been deterred by lack of knowledge on how to produce a good working job.

With regard to Mr Maskelyne's note, I do not think many people would want to build in less than



The modified bracket designed by Mr Howard for VIRGINIA'S *reversing quadrant*

3½ in. gauge; in the club to which I belong large engines are most popular.

At present I am building *Virginia* (older version) and the chassis is complete except for cylinders. Working leaf springs have been fitted and the valve gear is almost complete. In fitting up the reversing lever I had trouble as the bracket for the quadrant is joined to the frame where there are already four screws. To avoid weakening the frame I extended the pivot bracket backwards, formed a socket in it for the quadrant leg and brazed the joint as shown.

Ewell, Surrey. D. C. HOWARD.

SIR,—How about the Talyllyn's No 2, *Dolgoch*, as an interesting and unusual model? *Dolgoch* is an 0-4-0 well tank engine built about 1865, with outside cylinders driving the rear pair of wheels.

The motion, Allen's straight-link, works on the front axle and the links are near the firebox, facing forward, and there are reach-rods connecting the links with the valve spindles under the smokebox.

No 2 is a very powerful engine and I think would be very interesting to make.

Torquay, Devon. F. H. BEYNON.

SIR,—May I support the suggestion that the successor to *Virginia* should be an L.N.W.R. Prince of Wales in 2½ in. or 3½ in. gauge? May I also suggest that it should be given a genuine L.N.W. name and number and that *Stentor*, No 522, would be suitable? I believe the original Stentor was a town crier of Ancient Greece, remembered for his remarkably loud voice, and such a description certainly fitted the Princes when they were doing the hard work of the L.N.W.R.

The front end will be a little ticklish on account of the large cylinders and large bogie wheels but possibly the cylinder could be fitted like G.W. inside cylinders (as on Stars, etc.) and lifted to give the leading bogie wheels sufficient play.

Rugby. JOHN H. REYNOLDS.

SIR,—I would like to join in the plea for a design for a Shay locomotive as L.B.S.C.'s next serial. There must be many readers who, possibly inspired by V. H. Messer's notable example in MODEL ENGINEER for 23 October 1952, would like to tackle one of these fascinating machines but have been deterred by lack of suitable drawings.

Coming from such an able designer as L.B.S.C., we could rest assured that in addition to its being well out of the common run of Pacifics and the like, it would be a powerful performer on the track. I feel sure that a 1 in. scale engine, arranged for either 2½ in. or 3½ in. gauge, would prove very popular.

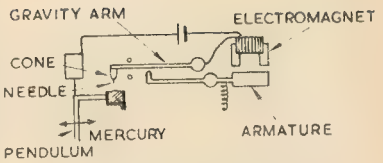
Lincoln. HUGH F. PAXTON.

FREE PENDULUMS

SIR,—Mr Clark, who inquired about pendulum clocks with small variations in arc, may be interested in a modification of Gill's mechanism which occurred to me.

Gill's pendulum cannot be called free, because a certain mechanical force is necessary to operate the contact, which robs energy from the pendulum. My modification, though not a free pendulum, reduces this fault.

The contact is a needle, fixed to the



Mr Peverley's modification to the Gill pendulum mechanism

gravity arm, which dips in a cup of mercury attached to the pendulum. The impulse is imparted by the cone attached to the gravity arm which dips into the mercury so that the weight of mercury displaced gives the impulse. The count wheel is operated by the armature, of course.

This is an improvement in that very little force is necessary to operate the contact. I made such a clock in Meccano a few weeks ago and it worked all right, but it was expensive on batteries. (It exhausted a 6 v. lantern battery in a week.) This is much below the standard of my Meccano "Hipp" clock which will go for 18 months on a similar battery. The accuracy of both clocks was limited by their total lack of temperature compensation to two or three seconds a day.

For real accuracy, of course, one must turn to the true free pendulum clocks. The principle of such clocks is that a separate clock is used to time the release of the gravity arm which, after sliding off the impulse face of the free pendulum, hits a contact and is reset by an electromagnet, at the same time sending a synchronising signal to the slave clock which is kept in step with the free pendulum to within about 0.01 sec.

Thus the free pendulum is totally free except for the necessary interference of imparting an impulse, which is confined to about one per cent. of the total time.

The Shortt-Synchronome free pendulum, for example, is enclosed in an evacuated cylinder and its angle of swing is constant to within a few seconds of arc. Its accuracy is about 1/10 sec. per year or one part in 300,000,000 !

There is not enough space, unfortunately, to give further details of the mechanism of this, or other free pendulum clocks, but I refer Mr Clark to *Electrical Timekeeping* by F. Hope-Jones, which is full of information on free-pendulum clocks as well as other types leading up to them.

Free pendulum clocks are not outside the scope of the amateur, although no doubt an ordinary case will be seen more frequently than an evacuated cylinder !

York. J. R. PEVERLEY.

CLUB NEWS

EDITED BY THE CLUBMAN

QUEEN ELIZABETH the Queen Mother will see something of the pleasures afforded by live steam if plans now being made in Hertfordshire meet with the expected success.

Early next month, on June 8—the Saturday in Whitsun—the Hertfordshire Youth Movement is holding the Herts Festival of Youth at Hatfield Park. Live steamers in that area would like to provide the festival with an engine rally and are at present working on one of the proposed special attractions—the Fowler ploughing engine No 13422 which has been acquired by a Broxbourne enthusiast after she had been standing for 10 years.

I am told by Buckingham Palace that the Queen Mother, who has, of course, a deep affection for Hertfordshire, is to attend the festival. Everything, therefore, points to its being a huge success, and I hope that all readers who can conveniently send an engine will communicate as soon as possible with J. E. McComb of 4 Wigmores South, Howardsgate, Welwyn Garden City.

Getting her ready

Writing from Welwyn (Old Welwyn) F. W. Barker says that the Fowler has been retubed by her friends—all old readers—and that they were taking her to Broxbourne and giving her a thorough clean for the great day.

While some are at Hatfield Park, others on the same day will be at Bridge Farm, Appleford—near Andover in Hampshire—for the Appleford steam traction engine rally. Veteran and vintage cars have a place in the programme, which opens at two p.m. with admission from noon onwards.

Secretary George Shipman of 14a Neville Street, London (headquarters for the National Traction Engine Club) will be glad to send full details.

OPEN DAY FOR GLASGOW

After winning new friends—and new members—at the Schoolboys' and Schoolgirls' Exhibition at the Kelvin Hall, **Glasgow S.M.E.** (whose secretary is Andrew Hall of 71 James Nisbet Street, Glasgow, N.1) is having an open day, with everyone welcome, at the track on June 2.

This is the society's fifth special event since mid-April, the others being an auction sale, a talk on a White Steam Car, a trip to see this romantically mysterious vehicle, and a visit to the Hydepark Works of the North British Locomotive Company.

Yet a little while ago Glasgow S.M.E. was in the doldrums.

CAN YOU HELP ?

Far from Glasgow, on the well-known track at Waverley Street in Diglis—just off the main Bath road—**Worcester and District M.E.S.** is having another public running day, its second this year, on June 6.

The first was on May 19. There will be another on July 21.

Secretary F. L. Fudger of 23 Camp Hill Road, Battenhall, Worcester, wants it to be known that any lone modeller or any locomotive club is welcome on these days—especially those with 5 in. gauge locomotives who would be prepared to help out with "a bit of passenger hauling." All running is done on the continuous Waverley Street track.

THEY'RE GOING BY DIESEL !

Besides the National Rally at Campbell Green on September 7 and 8, **Birmingham S.M.E.** has no fewer than 18 events arranged for the summer.

They begin with the members' social day on May 26 and the annual outing to the Wye Valley in (would you believe it ?) a diesel train on June 1. Track running occupies the Whitsun, at Great Barr Horse Show on the Saturday and Shirley Carnival on the Monday. Indeed, there is track running somewhere Saturday after Saturday except when something very special intervenes, such as the big West Midland Rally at Wolverhampton on June 15 and 16. I hope that the event at Erdington on the same Saturday as the rally will have excellent support. The running on this occasion is at Princess Alice Orphanage.

The society, in readily giving its help to various organisations and institutions from an orphanage to an old folk's community, asks for the assistance of members who can provide locomotives or give a hand with the erection of the portable track. In addition, secretary J. G. Adams of 32 Cropthorne Road, Shirley, Birmingham, wants plenty of models for the exhibition at Birmingham Conservative Fete in Highbury Park, King's Heath, on July 6.

M.E. DIARY

May 24.—Port Talbot Neath and District S.M.E., trackwork night, Old Melyn Works, 7.15 p.m.

May 25.—S.M.E.E. track meeting (locos requested), Wanless Road, London, 2.30 p.m. Edinburgh S.M.E. Bring and Buy sale, club rooms, 3 p.m. Hannington Grange Steam Rally (May 25 and 26).

May 26.—Forest Gate M.P.B.A. regatta. Birmingham S.M.E. Members' Social Day, Campbell Green. Brighouse S.M.E.E. Visiting Day, Ravensprings Park.

May 28.—I.R.C.M.S. Hull Group, Sportscraft, Beverley Road, Hull, 7.30 p.m.

May 29.—North London S.M.E. miniature railway section, H.Q., 8 p.m.

May 31.—Port Talbot, Neath and District S.M.E. end of session; general discussion, Old Melyn Works, 7.15 p.m.

June 2.—Bedford M.P.B.A. regatta, Glasgow S.M.E. open day at track. I.E.E. visit to Stratford-upon-Avon.

CHANCE FOR VISITORS

Visitors who wish to use the multi-gauge track of the **West Riding Small Locomotive Society** at the society's two-day rally in June will be given this facility for the longest possible time, depending on the number of locomotives that are brought along. Fuel, oil, bogies and batteries for blowers will be obtainable.

As most readers of this page are aware, West Riding S.L.S. has one of the finest, safest and fastest continuous multi-gauge tracks in the country, with a circuit of 220 yards and provision for engines of $2\frac{1}{2}$ in., $3\frac{1}{2}$ in., $4\frac{3}{16}$ in., 5 in., and $7\frac{1}{4}$ in. gauge.

There is a welcome for everyone at the rally. It opens at 10 a.m. on June 1 and closes at 10 p.m. on June 2, a Sunday. The society is making special efforts to attract clubs and private individuals from a wide area and is arranging to accommodate caravans and tents on the site as well as providing sandwiches and other refreshments. Hotels are, however, to be found within reasonable distance as the site is about five miles from both Leeds and Wakefield, on the Bradford-Wakefield main road.

Secretary A. Balmforth at 24 Thornton Lane, Bradford, has all the details.

Model Engineer

Classified Advertisements together with remittance should be sent to Model Engineer, 19-20 Noel Street, London, W.1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 4

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WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

Immediate Delivery from Stock, Myford "ML7" and "Super 7" lathes, Super Adept lathes, bench planers, shapers, electric motors, small tools.—F. W. KUBACH, 12, Sylvan Road, London, S.E.19. LIV 3311/12.

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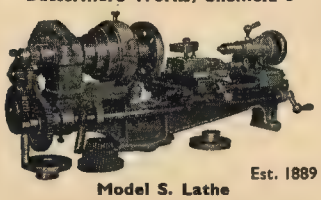

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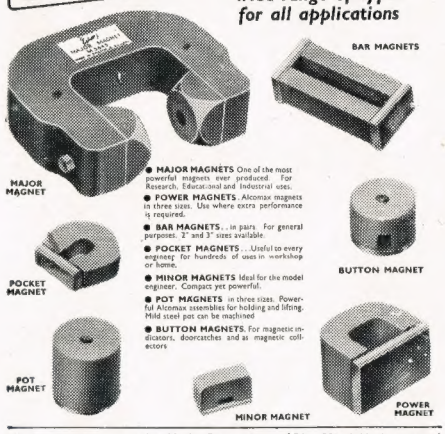

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Little Giant
TOOL POST GRINDER

For use on

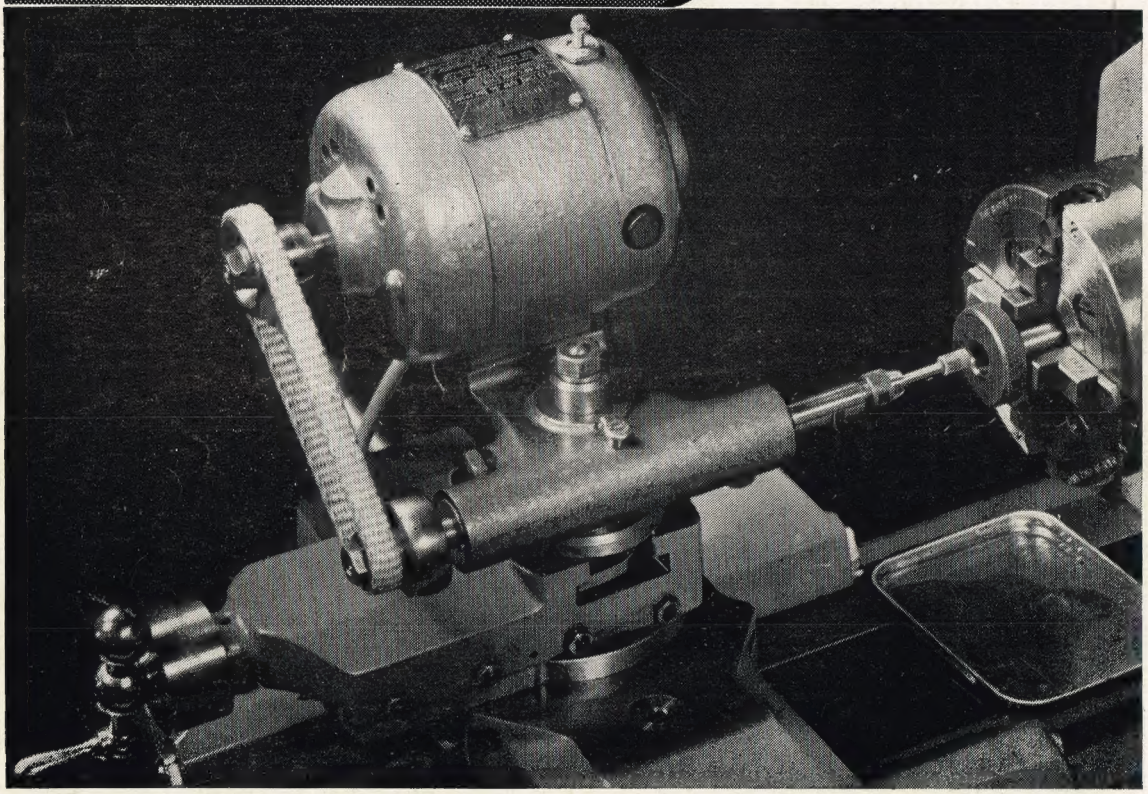
BOXFORD

SOUTH BEND

AND MOST OTHER

TYPES OF

LIGHT LATHES



The illustration shows the Little Giant Tool Post Grinder being used for internal grinding. A 2 in. diameter wheel is supplied for external grinding, making this accessory universal and a most useful addition to your lathe, enabling you to obtain a higher standard of finish on many components.

The Grinder is supplied in a neat metal box with fittings for the accessories.

PRICE £23 0s. 0d.

Send for illustrated brochure and full details to :—

DENFORDS ENGINEERING CO., LTD., HECKMONDWIKE, YORKS.